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Summary of Progress *of the* GEOLOGICAL SURVEY OF GREAT BRITAIN *and the* Museum of Practical Geology for the Year 1934

PART I

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Summary of Progress

of the

Geological Survey of Great Britain

and the

Museum of Practical Geology

for the Year 1934

PART I

With Report of the
Geological Survey Board and
Report of the Director

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REPORT OF THE GEOLOGICAL SURVEY BOARD FOR 1934

TO THE LORDS OF THE COMMITTEE OF THE PRIVY COUNCIL FOR SCIENTIFIC AND INDUSTRIAL RESEARCH

MAY IT PLEASE YOUR LORDSHIPS.—

In accordance with our terms of reference, we, the Geological Survey Board, beg leave to submit our Fifteenth Annual Report on the work of the Survey and Museum.

Field Work

The Director's Report which is submitted herewith shows that approximately one third of the time of the field staff was necessarily employed in the preparation of exhibits for the new Museum. Although Survey work was correspondingly restricted, it was nevertheless carried on in all except one of the districts included in the programme for the year. The only area in which it was found impossible to continue field work was that of Sevenoaks.

The primary survey of the Shetland Islands has now been completed. It was not found necessary to employ a full unit on this area for the whole year, and two field officers were therefore transferred to a new district in the north of Skye.

The Field Units were engaged in the undermentioned districts:—

Southern District (primary six-inch survey).

West Midlands and Cambridge Districts (primary six-inch survey).

Yorkshire District (revision of six-inch survey).

Lancashire District (revision of six-inch survey).

Forest of Dean (primary six-inch survey).

Northumberland and Durham District (revision of six-inch survey).

Central Coalfield and Fife (revision of six-inch survey).

West Highland District (primary six-inch survey).

Shetland (primary six-inch survey).

Skye (primary six-inch survey).

Details of the work carried out by each of the Field Units mentoned above are given in the *Summary of Progress* (pp. 45-71).

New Survey Offices and Museum at South Kensington

It is with great satisfaction that we record the transfer of the Offices, the Library, and the Museum collections from Jermyn Street to the new building in Exhibition Road, South Kensington. An account of the important work of removal and of the arrangements made in the new building is given in the Report of the Director (pp. 37-40). The removal was begun in January and completed by the end of October, 1934. Throughout this period, the normal work of the Survey was carried on without any serious interruption.

The Library at Jermyn Street was closed to the public late in July, and the Library at South Kensington was made available to the public in the first week of November. During the intervening period, the Council of the Geological Society of London very kindly allowed enquirers to consult the published Geological Survey maps in the Society's Library at Burlington House.

The new Museum will be opened to the public as soon as possible after the formal opening ceremony in July, 1935.

Publications

Progress has been maintained in the publication of maps.

In England nineteen six-inch uncoloured sheets of the Lancashire, Northumberland and Yorkshire coalfields have been issued.

Of the new series of colour-printed six-inch maps of the London District mentioned in our previous report fifteen have now been published and it is anticipated that the issue of the sheets which cover the more populous inner areas will be practically completed during 1935.

In Scotland one one-inch colour-printed and two six-inch uncoloured coalfield maps have been published.

Apart from the Annual Summary of Progress only two memoirs have been issued during the year, namely, the second part of the economic memoir describing the Fife Coalfields and a Guide to the Geological Model of Ardnamurchan.

A new departure has been made, however, by the preparation of regional handbooks descriptive of British Geology, which will be more simple and comprehensive than the sheet memoirs. It is intended that these should also serve as descriptive guides to the exhibits of British geology in the new Museum. By the end of the year four of these Regional Guides were in the press and the preparation of eight others was well advanced.

Soil Mapping, Agriculture and Forestry

Close co-operation with agriculturists and soil experts has continued to be maintained. The Soils Correlation Committee of the Ministry of Agriculture and Fisheries in conjunction with the

Department of Agriculture for Scotland, has been superseded by a Soil Surveyors' Conference with a standing Executive Committee. One geological surveyor has served on this Committee and he attended the field meeting of the Conference which was held near Belford, Northumberland. A field officer of the Northumberland Unit also attended.

Samples of soils submitted by the Forest Products Research Laboratory have again been examined and reported on by field geologists.

Investigation of Building Stones

A joint committee of officers of H.M. Office of Works, of the Building Research Station and of the Geological Survey was set up in connexion with the selection of stone suitable for the repair of the stonework of the Houses of Parliament. One geological surveyor has been appointed to advise on geological problems which might arise.

The Curator has represented the Geological Survey and Museum on the Standing Chemical and Weathering Committee of the Building Research Board.

As in previous years advice on stones suitable for building purposes has been given.

Fuel Research

Officers of the Geological Survey have continued to co-operate with the local committees of the Physical and Chemical Survey of the National Coal Resources under the Fuel Research Board.

Water

The number of water-supply enquiries from the general public has greatly increased during the year.

The Assistant to the Director in England continued to serve on the Committee of the British Association on Inland Water Survey and has attended conferences at the Ministry of Health on the same subject. One geological surveyor has given assistance to the River Mersey Committee of the Water Pollution Research Board.

Conferences

The Director represented the Geological Survey and Museum at the British Association in Aberdeen and the Assistant to the Director in England attended the Jubilee Celebrations of the Swiss Geological Society.

Membership of the Board

In accordance with the arrangements governing the period of service of members of the Geological Survey Board, Mr. C. W. Hobley, Professor H. Louis and Professor S. H. Reynolds retired at the end of March, 1934. They were succeeded by Sir Edwin Pascoe, Mr. J. Romanes and Professor H. H. Swinnerton.

Death of Dr. F. L. Kitchin

It is with deep regret that we record the death, on 20th January, 1934, of Dr. F. L. Kitchin, F.R.S., who had been Palaeontologist to the Geological Survey since 1905.

Programme for 1935

The programme of field work approved for 1935 is:—

(a) Primary mapping on the six-inch scale in Skye, Inverness-shire, Forest of Dean, Droitwich, Sevenoaks, Bridport, Biggleswade and Huntingdon districts;

(b) revision of original six-inch mapping in the following coalfields and adjacent areas:—Northumberland, Lancashire, Cheshire, Yorkshire and Fifeshire;

(c) investigation of underground water-supplies, examination of mineral resources, verification of bore records, and collaboration with soil-surveyors;

(d) collection of Museum specimens, and photographing of geological subjects for enlargement.

As it will probably be necessary to keep several of the field surveyors at Headquarters to prepare Museum exhibits during the first half of the year, the field programme may be restricted.

T. Franklin Sibly,
Chairman.

4th, April, 1935.

SUMMARY OF PROGRESS OF THE GEOLOGICAL SURVEY AND MUSEUM FOR 1934

I. REPORT OF THE DIRECTOR

THE year 1934 will remain memorable in the history of the Geological Survey and Museum as it has seen the transfer of offices, library and collections from Jermyn Street to the new building in Exhibition Road, South Kensington. The evacuation of the old building, which had been occupied for 84 years, began in January and was completed on 31st October, when the keys of the Jermyn Street Museum were handed over to H.M. Office of Works. The year has consequently been one of strenuous activity of a rather unusual description and it is gratifying to be able to report that all departments of the Survey's work have been carried on without serious interruption, that the collections have been transferred in excellent preservation and order, and the new offices and laboratories have proved eminently satisfactory for the purposes for which they were designed. In the execution of this work much responsibility devolved on the staff of H.M. Office of Works by whom all the operations have been carried out smoothly and efficiently and with a minimum loss of time.

Survey Work

The number of men employed in the field during the year has been considerably lessened owing to the necessity of retaining some of the field geologists in London for several months or for the whole year in order to accelerate the preparation of exhibits for the new Museum. As a general estimate it may be said that approximately one-third of the time of the field staff was so employed. One officer from the Scottish staff, Dr. W. Q. Kennedy, and one from Northumberland, Mr. V. A. Eyles, have been at work in London during the whole of 1934. Two officers in Edinburgh, Mr. A. G. MacGregor and Dr. J. Phemister, have not done any systematic field work during the past season but have been busy in Edinburgh preparing exhibits to illustrate the geology of Scotland. In England, Mr. H. G. Dines and Mr. F. H. Edmunds have been entirely occupied in Museum work on economic geology and on the geology of various districts of England. Other geologists, including Mr. H. Dewey, Dr. F. B. A. Welch, Dr. R. L. Sherlock, Mr. T. Eastwood, Dr. R. W. Pocock, Mr. T. H. Whitehead and Mr. W. C. C. Rose, have collaborated in the preparation of museum exhibits.

The Museum and Library Staffs have given their whole time to the packing and checking of the collections transferred from the old to the new Museum, and to the arrangement of the rocks, fossils and books in their new quarters.

Staff Changes

The Survey has suffered a grave loss, during the year, by the death of Dr. Finlay Lorimer Kitchin, F.R.S., Palaeontologist, who was suddenly taken ill when at work in his room in the Jermyn Street Museum, and died in St. Thomas's Hospital two days later, on 20th January, 1934. Dr. Kitchin had served as Palaeontologist to the Geological Survey, and chief officer in charge of the exhibits of fossils in the Museum since May, 1905, when he succeeded E. T. Newton, F.R.S. His distinguished services to British palaeontological science were universally recognized and he had been awarded the Lyell Medal from the Geological Society of London in 1934. He was author or contributor to a number of classical geological monographs and memoirs, and was a specialist of high standing in Jurassic palaeontology.

Diligent and unremitting in his official activities, he had earned the deep respect of all the Staff, and his generous co-operation and friendly assistance rendered him a favourite with his colleagues and gave him also a wide circle of friends among the public interested in British geology.

The vacancy created by Dr. Kitchin's death was filled by the promotion of Dr. John Pringle who had been for several years in charge of palaeontological work in the Edinburgh office and the Survey's collections in the Royal Scottish Museum. The transfer of Dr. Pringle from Scotland left a vacancy in the Scottish staff which has not yet been filled owing to the insistent claims for palaeontological work arising from the arrangement of the fossils exhibited in the new Museum in London.

Towards the close of the year two vacancies in the field staff were filled by the appointment of Mr. K. P. Oakley and Mr. C. F. Davidson. These officers have proved very useful in assisting the work of their colleagues in the Museum during the last three months of the year. One vacancy remained but was filled in January, 1935, by the appointment of Mr. F. W. Anderson.

The vacancy for an Assistant Librarian was filled in March by the appointment of Mr. F. W. Cope.

Owing to the fact that two Museums were occupied during the first ten months of the year it was necessary to employ an increased staff of warders, carpenters, labourers, etc., but these requirements have been adequately met.

Mr. David Tait, who had been a member of the staff of the Geological Survey (Scotland), for 37 years, retired from the service on 24th May, 1934.

Mr. Tait, in addition to his official duties, which he had performed in a manner giving the utmost satisfaction, had contributed many useful papers to scientific journals on problems relating to Scottish geology, and especially to the evidence afforded by temporary exposures in the neighbourhood of Edinburgh.

Field Work

The programme of field work for the year involved no serious change in the arrangements for the staff. It proved impossible, owing to the demands of Museum work, to continue the survey of the Sevenoaks Sheet (287) which is about half completed and will be resumed in 1935. On the other hand, a good deal of useful work has been done by Dr. S. Buchan, who had been surveying in that district, in revising the six-inch maps of London in connexion with the new series of six-inch colour-printed maps of the London district which is passing through the press.

The only new district that has been opened is the north of Skye. As a full staff was not required in Shetland to complete the primary six-inch survey, two geologists, Mr. D. Haldane and Mr. J. Knox, were transferred to the Trotternish district of Skye and have made progress with the primary mapping of that ground.

Less work than usual was done in the Carboniferous districts of Central Scotland during the late Autumn as the geologists were busy writing memoirs on the Kilsyth Coalfield of Stirlingshire, the Leven Coalfield of Fife, and the Sanquhar Coalfield of Dumfriesshire, and such time as they spent in the field was mostly occupied in completing the information needed for the memoirs.

In spite of the restricted amount of field work that could be undertaken owing to the claims of Museum duties and publications, several Sheets have been finished during the year. The whole of Shetland, representing nine one-inch Sheets (123-131) is now surveyed. In Western Argyllshire the Morvern or Strontian Sheet (52) was completed.

In England the Biggleswade Sheet (204), which is one of the four sheets surrounding Cambridge, was finished by Mr. E. E. L. Dixon and Dr. R. L. Sherlock. At the close of the year three other Sheets were near completion but could not be finished owing to bad weather. These are the Preston Sheet (75), Lancashire, and the Elsdon (8) and Morpeth (14) Sheets in Northumberland.

It is anticipated that in 1935 the field staffs that have been occupied during 1934 in Museum duties will be liberated for field work about the end of June and survey will then be carried on in all the districts which are included in a normal programme.

In the preparation of the twelve colour-printed six-inch maps of the London district which has taken up much of the time of Mr. Dewey and Dr. Buchan much assistance has been received from the engineers and surveyors of the London County Council who have permitted access to their records. The municipal surveyors of the various London boroughs have also given constant assistance when requested. Many temporary exposures have been visited and a record is being obtained of the rocks shown in the trenches of the new West Middlesex sewage scheme. The firms of water engineers who are employed in boring wells in London, have, as in previous years, most willingly contributed information from their records.

On these new maps an attempt has been made to show the courses of the old buried streams that flowed through London to the Thames. These are not only of geographical and historical interest but also of some importance to builders and engineers as occasionally flooding takes place after sudden, heavy rains, where these old streams are known to have been located.

Of these new London six-inch maps 15 were published before the end of 1934, 15 were in the press, engraving and colour-printing and a number were in hand being prepared for the engraver. It is anticipated that most of the densely populated parts of London will be published before the end of 1935 and it will then be possible to consider the publication of some of the outer suburbs where building and development are very rapidly going on.

A special brochure descriptive of these London colour-printed maps has been prepared and will be circulated widely to geologists, engineers and business firms interested in the geology of London.

In Dorsetshire, Dr. Welch has made good progress in the mapping of the Jurassic rocks of the Bridport Sheet (327), a district which had never been completely mapped on the six-inch scale. On this ground he had some assistance from Mr. W. Lloyd who was, however, unable to do field work for the whole of the season owing to ill health. It is anticipated that this map will be nearly completed by the end of the coming year. Dr. Welch has also contributed to the series of handbooks of British Regional Geology which is being prepared for publication to explain the exhibits in the new Museum.

The six-inch mapping of the country around Cambridge, which has been the subject of urgent demands for many years, has been carried a stage further by the completion of the survey of the Biggleswade Sheet (204). Cambridge lies near the junction of four New Series one-inch Sheets. The map on the south-east, Saffron Walden (205), has been published with a memoir. The Biggleswade Sheet is to the south-west of Cambridge. The Sheet that is to the north-west, Huntingdon (187), has been started. Owing to the widespread cover of drifts much of the information regarding the ' solid ' geology has to be obtained from well-sinkers and boring engineers and Mr. Dixon during the past year has diligently collected a large number of records from the whole of that district.

The last of the coalfields of the West Midlands is now receiving revision. Dr. S. E. Hollingworth has been engaged for part of the year in surveying the Droitwich Sheet (182) which contains the south end of the Forest of Wyre coalfield. The Sheet to the north of it, the Dudley Sheet (167), was finished last year and Dr. R. W. Pocock and Mr. T. H. Whitehead are preparing the map and writing the descriptive memoir for publication.

On the completion of the re-survey of the Cumberland coalfield the staff was transferred to other districts, and Mr. T. Eastwood, Dr. F. M. Trotter and Mr. W. C. C. Rose have spent part of the last summer and autumn in a revision of the Forest of Dean. Though no six-inch geological maps of this interesting field have ever been made the structure is reasonably well-known through the researches of Sopwith and other geologists. The field is a small one and about one-half of it was surveyed during 1934. Some of the officers were also employed on Museum work. An extensive area of older rocks, principally Old Red Sandstone, surrounds the coalfield and will have to be revised before the new one-inch map can be sent in for publication. By the close of 1935 it is anticipated that most of the coalfield will have been examined and that the six-inch Sheets that are required for publication can be put in hand.

In Lancashire the Preston Sheet (75), which contains an important area of coalfield, was actively surveyed by Mr. T. H. Whitehead, Mr. L. H. Tonks and Mr. R. C. B. Jones under the superintendence of Dr. W. B. Wright. At the close of the year it was practically completed and a few weeks of good weather would have enabled the geologists to finish it. The six-inch maps of the coalfield can now be drawn for the engraver and the one-inch Sheets, Solid and Drift, will follow. At present the draughtsman is fully employed with the one-inch Sheets of Wigan (84) and the illustrations which are required for the corresponding memoir. The four most important Sheets of the Lancashire Coalfield, Rochdale (76), Manchester (85), Wigan (84) and Preston (75) have now been the subject of a most exhaustive revision and there remain a number of surrounding Sheets which contain restricted areas of Coal Measures. When Preston is completed the work will be extended southwards into the Warrington Sheet (97) which was partly surveyed on the six-inch scale by Hull about 1865. This Sheet contains some interesting areas of coalfield and adjoins the Liverpool Sheet (96) of which a complete six-inch revision was published in 1923.

With the completion of the revision of the Barnsley (87) and Wakefield (78) Sheets in 1934 the Yorkshire staff had a heavy task to prepare all the six-inch Sheets and the corresponding one-inch Sheets for engraving, and the memoirs for printing. Two of the officers also, Mr. C. E. N. Bromehead and Dr. D. A. Wray, have been very busy with Museum work, assembling specimens for exhibit and writing contributions to the British Regional Geology handbooks. Consequently, only one of the officers of this staff has been much in the field during the past season. Dr. G. H. Mitchell has carried on the re-survey of the Bradford Sheet (69). Only in the southern part of this Sheet do Coal Measures occur, the remainder being Millstone Grits and Yoredale Beds. A considerable area of these last has been revised and this work will be continued next season. Mr. J. V. Stephens and Mr. W. N. Edwards have been actively engaged in preparing six-inch coalfield Sheets for the engraver. The one-inch Sheets and the memoirs have still to be undertaken.

In Northumberland, Mr. R. G. Carruthers and his staff have done much field work partly in the upland districts where Lower Carboniferous rocks occupy most of the ground and partly in the coalfield area to the north of Newcastle. Mr. A. Fowler and Mr. W. Anderson have practically finished the Elsdon Sheet (8) and also most of the Keilder Sheet (7). These contain small areas of Scremerston Coals and the re-survey should be completed next year. The Morpeth (14) and Tynemouth (15) Sheets are also in an advanced state of preparation but as they contain important coalfields the work is necessarily laborious. Meanwhile the memoir on Rothbury has been completed and is in the press. The Rothbury (9) and Newbiggin (10) Sheets were published in Solid and Drift editions in 1934. Mr. Eyles, who belonged to this division, has been constantly employed in the London office during the year, doing Museum work on economic geology.

In the Cumberland coalfield no new work was done during the year except where required to complete the information needed for the maps and memoirs that are in hand. The standard copies of the six-inch Sheets of Gosforth were prepared by the geologists and the one-inch Sheet (37) was nearly finished in dry-proof and made ready for engraving. The Cockermouth Sheet (23) also awaits publication. The Gosforth memoir is drafted in manuscript but not yet sent to press.

In Scotland the Highland field season was carried on almost in full vigour but work in the Lowlands was less active than usual owing to other calls on the time of the geologists. A notable accomplishment was the completion of the primary survey of Shetland under Mr. G. V. Wilson, District Geologist. This county, though only 550 square miles in area, is scattered over nine one-inch Sheets, and, as all the rocky islands had to be examined, there was much boating to be done, which was possible only in fine weather. The anticipated delays, however, proved comparatively unimportant and Mr. G. V. Wilson, Mr. J. K. Allan, Dr. T. Robertson and Dr. S. Buchan finished the work in good order.

Part of the staff that was employed in Shetland in the previous year was sent to the north of Skye and began survey in Trotternish. A good start was made in this area and it is expected that a full staff will be at work in Skye next summer.

In Western Inverness-shire and Argyll, Dr. J. E. Richey and his staff finished the survey of the Morvern Sheet (52) and advanced northwards into the Arisaig Sheet (61). This is a region of very complicated geology, including many types of metamorphic schists, gneisses, granites and basic intrusions. Much work requires to be done before the petrology of this Sheet has been fully investigated and the results are ripe for publication. It is probable that a single memoir will be written for these two Sheets as they have much in common in the principal features of their geology.

A revised series of six-inch Sheets of Stirlingshire is being issued by the Ordnance Survey and as these are on a new meridian they do not fit exactly with the surrounding Sheets which were pub-

lished on the old meridian. As some of the latter are sold out and fresh copies were called for, opportunity has been taken to correct and improve the geology of these six-inch Sheets before publishing them on the new meridian. The alterations are seldom important but the maps are being brought up-to-date by Dr. Robertson and Mr. J. K. Allan by incorporating the latest information obtained from borings and mining plans.

In Fife, also, new coalfield maps are passing through the press and Mr. Knox and Mr. Allan have been preparing six-inch Sheets of the Leven coalfield.

Similarly in Dumfries-shire the coalfield of Sanquhar, recently resurveyed by Dr. J. E. Richey, Mr. A. G. MacGregor and Dr. J. B. Simpson, is being published, both on the six-inch and on the one-inch scale. A short memoir on this field has been written and is nearly ready for the press.

These maps bring very nearly to a conclusion the publication of the revision of the Scottish coalfields that was authorized in 1900 and has been continuously in progress during the spring and autumn seasons since that date. The work, of course, was interrupted during the war when the energies of the staff that remained in Scotland were directed principally to special researches on problems connected with military, naval and economic requirements. At the present time only very small areas of coalfield remain to be examined. Several areas of the Scottish Carboniferous have already had a second revision. The oldest six-inch maps are now those of the Midlothian coalfield in which the revision was started in 1900. Some of these date from 1906 and, being 30 years old, are obsolescent. The oil-shale fields of the Lothians were the subject of a second revision about the year 1920 and three editions of the descriptive memoir have now been published. In the Glasgow district some of the maps, recently sold out, have been brought up-to-date and new editions published.

Publications

Maps

Of the quarter-inch maps of England two Sheets have been published during the year and six Sheets are in the press and will be issued in 1935. These Sheets are a revised issue, brought up-to-date according to the latest surveys, and printed on an improved colour scheme which is intended to give more distinctness while not sacrificing detail. Of this new edition nineteen Sheets, are published or in the press and the remaining Sheets, which are five in number, will be sent to the engraver as soon as the pressure of other work permits. The map has a ready sale and is very useful not only for teaching purposes but also to motorists and tourists who are interested in geology.

Unfortunately, it is only possible to issue this popular map in a ' Solid ' edition as very considerable areas of the south and west of England were originally surveyed on the one-inch scale (as six-inch

topographical maps were not yet available), and for many years the drifts were not examined in detail during the primary survey. Much of that ground has been subsequently revised on the six-inch scale, but it is not at present possible to publish Drift maps of the whole of England. In Scotland, however, since the inception of the survey the drifts have been mapped as carefully as the solid.

For quite another reason it has not been possible to publish a complete quarter-inch map of Scotland; *viz.* the incomplete condition of the survey of large parts of the Highlands. A notable advance has been made in this direction during the past year by the appearance of Sheet 5, Scotland, which shows a large area of Northern Sutherlandshire and Ross. This map will provide a cheap and handy index map to geologists wishing to examine the classic regions of the north-west Highlands. It was first exhibited at the meeting of the British Association in Aberdeen in September, 1934, and received a hearty welcome.

The quarter-inch map of the Orkneys (Sheet 3) was published in 1932 and will be followed as soon as possible by the two quarter-inch Sheets of Shetland (1 and 2). As the mapping of that country is now finished, Mr. G. V. Wilson and his staff will proceed to draft the quarter-inch and one-inch maps and before long they will be sent to the engraver.

Of the maps on the scale of one-inch to one mile four Sheets have been published, two solid and two drift, to illustrate the geology of Northumberland.

A revised edition of the Lizard Sheet has also appeared during the year. The previous edition had been sold out for two or three years, and recent researches had thrown much new light on the stratigraphical sequence in that area. These necessitated important alterations in the interpretation of the mapping, and, after a fairly complete examination of the ground, it was decided to adopt an entirely different hypothesis of the structure of the northern part of the Sheet. The evidence of the fossils clearly indicated that rocks formerly supposed to be Ordovician were probably not older than Middle Devonian. The previous mapping, however, had been done with such care that few of the boundaries needed modification; and except that several rock groups were combined, and the presumptive age of the rocks modified to suit the recent advances in knowledge of their fossil contents, the changes rendered necessary are not very extensive.

The maps which were in the press at the close of the year include ' solid ' and ' drift ' editions of the very important Wigan Sheet (84), one of the most complicated coalfield Sheets in Britain, not only on account of the great thickness of productive Coal Measures but also because that area is traversed by numerous important faults of which full information can be obtained only by a study of the mine shafts and plans.

In Scotland three one-inch maps are in the press, two being the ' solid ' and ' drift ' editions of the Sanquhar Sheet (15), in which the Carboniferous and Old Red Sandstone areas have

received a thorough revision. The Jedburgh Sheet (17) also has been similarly revised. All these Sheets contain large areas of Ordovician and Silurian rocks which were re-mapped many years ago by Peach and Horne, and the results were published in detail in their memoir on the Silurian Rocks of Scotland. The issue of the new colour-printed Sheets of the south of Scotland is still incomplete. Ten Sheets are published; two are in the press and there are still three or four required to bring the series up-to-date.

Although the number of one-inch Sheets published, and in the press, during the year is smaller than usual there is a considerable number which are so completely surveyed that the draft copies are being prepared or will soon be in hand. They include Morpeth, Cockermouth, Gosforth, Wakefield, Barnsley, Preston, Biggleswade, Dudley, and (in Scotland), Morvern and the nine Sheets of the Shetland archipelago.

Of the six-inch coalfield maps ten have been published for the Lancashire coalfield, four for Northumberland and five for Yorkshire. Only two have been published for Scotland, representing part of the Sanquhar and Lanarkshire coalfields. At the close of the year thirty-two English six-inch Sheets and two Scottish six-inch Sheets were being engraved.

A feature of the year's work that deserves special notice is the publication of twelve colour-printed six-inch maps of the London area. These represent the results of the latest survey brought up to date as far as possible by a careful examination of many recent records of borings and the information obtained from sewers, foundations and other temporary openings. Fifteen more Sheets of this series were in the press in January, 1935, and it is expected that the whole of the more densely populated part of London will be represented by maps of this type by the close of the year. These maps are strictly Drift maps; they show the nature of the surface formations at every place, but many boring records are included, wherever these can be obtained, and indicate very exactly the geological conditions so far as these are revealed in the bores. As the number of borings for water in certain parts of London is very great it is frequently possible to include only a typical selection of this information, and references are given to published accounts of borings to act as a guide in the search for fuller particulars.

The topography of these maps is very dense in many places, as all the streets are fully shown, and in order to give more emphasis to the geology it has been decided to print the Ordnance Sheets which serve as a basis for the map by grey ink and the geological notes and lines by a special printing in black ink.

The colours have been chosen to give great contrast, and in order to render them as transparent as possible a special simplified colour printing scheme has been adopted. Fortunately, the range of colours required is not a very large one.

As this is the first publication of geological maps of London on so large a scale it marks a distinct advance. Experience has

shown that a large number of people call at our library in order to inspect the hand-coloured reference maps of London that are kept there, and it is expected that these new maps will meet with a steady demand from surveyors, builders, architects, engineers and the public generally who require information on London geology.

Among the new maps that are in progress but not ready for publication mention may be made of a series of economic maps of England and Wales on the scale of sixteen miles to one inch. These are intended to show the distribution of sources of the principal useful minerals, and such maps have often been asked for not only for teaching purposes but also as the bases of reports and in reply to economic enquiries. On four or five Sheets it is hoped to show clearly the coalfields (exposed and concealed), limestones, lead, zinc, iron and copper deposits, and other features of economic geology. Probably some of these maps will be ready for issue during 1935.

On account of the very large amount of the time of the draughtsmen that has been taken up during the past year in the preparation of maps, diagrams and sections that are to be exhibited in the new Museum no English library copies of six-inch maps have been deposited during the year and only a few in Scotland. Further particulars of this Museum work will be given in the description of the Museum preparations.

One Vertical Section illustrating the Central Coalfield of Scotland was in the press.

The list of maps and vertical sections published and in the press during the year is given below :—

English and Welsh Maps published in 1934

¼ inch to 1 mile :—

Sheet 7.—Leeds, Manchester, York (*Solid, Revised*).
Sheet 14.—Aberystwyth, Carmarthen, Hereford (*Solid, Revised*).

1 inch to 1 mile :—

Sheet 9.—Rothbury (*Solid*). Original survey by W. Topley and published as Old Series Sheet 109 S.W. Resurveyed by R. G. Carruthers, A. Fowler, W. Anderson and J. Maden; R. G. Carruthers, District Geologist.

Sheet 9.—Rothbury (*Drift*). Original survey by W. Topley and published as Old Series Sheet 109 S.W. Resurveyed by R. G. Carruthers, A. Fowler, W. Anderson and J. Maden; R. G. Carruthers, District Geologist.

Sheet 10.—Newbiggin (*Solid*). Original survey by W. Topley and published as Old Series Sheet 109 S.E. Resurveyed by A. Fowler and J. Maden; R. G. Carruthers, District Geologist.

Sheet 10.—Newbiggin (*Drift*). Original survey by W. Topley and published as Old Series Sheet 109 S.E. Resurveyed by A. Fowler and J. Maden; R. G. Carruthers, District Geologist.

Sheet 359.—Lizard (*Drift*). Original survey on the one-inch scale by Sir H. T. De la Beche and published as Old Series Sheets 31, 32 and 33. Resurveyed on six-inch scale by J. S. Flett and J. B. Hill, and published in 1912. Republished with some revisions in 1934 by Sir J. S. Flett.

6 inches to 1 mile (Coalfield maps):—

Lancashire, 93 N.W.—Gathurst. Original survey by E. Hull. Resurveyed by Laurance H. Tonks; W. B. Wright, District Geologist.
Lancashire, 93 N.E.—Wigan. Original survey by E. Hull. Resurveyed by R. C. B. Jones; W. B. Wright, District Geologist.
Lancashire, 93 S.W.—Far Moor. Original survey by E. Hull. Resurveyed by Laurance H. Tonks; W. B. Wright, District Geologist.
Lancashire, 93 S.E.—Ince in Makerfield. Original survey by E. Hull. Resurveyed by R. C. B. Jones; W. B. Wright, District Geologist.
Lancashire, 101 N.E.—Ashton in Makerfield. Original survey by E. Hull. Resurveyed by R. C. B. Jones; W. B. Wright, District Geologist.
Lancashire, 101 S.W.—Blackbrook. Original survey by E. Hull. Resurveyed by R. L. Sherlock; W. B. Wright, District Geologist.
Lancashire, 101 S.E.—Haydock. Original survey by E. Hull. Resurveyed by R. C. B. Jones; W. B. Wright, District Geologist.
Lancashire, 102 N.W.—Westleigh. Original survey by E. Hull. Resurveyed by R. C. B. Jones; W. B. Wright, District Geologist.
Lancashire, 102 N.E.—Leigh. Original survey by E. Hull. Resurveyed by R. C. B. Jones; W. B. Wright, District Geologist.
Lancashire, 102 S.W.—Lowton and Lane Head. Original survey by E. Hull. Resurveyed by R. C. B. Jones; W. B. Wright, District Geologist.
Northumberland, N.78 S.E.—Seaton Sluice. Original survey by H. H. Howell and W. Topley. Revised by G. A. Burnett; R. G. Carruthers, District Geologist.
Northumberland, N.86 N.W.—Seghill. Original survey by H. H. Howell and W. Topley. Revised by G. A. Burnett; R. G. Carruthers, District Geologist.
Northumberland, N.86 S.W.—Killingworth. Original survey by H. H. Howell and W. Topley. Revised by G. A. Burnett; R. G. Carruthers, District Geologist.
Northumberland, N.86 S.E.—Shiremoor and Murton. Original survey by H. H. Howell. Revised by G. A. Burnett; R. G. Carruthers, District Geologist.
Yorkshire, 218 N.E.—Halton. Original survey by J. C. Ward and R. Russell. Resurveyed by Wilfrid Edwards; C. N. Bromehead, District Geologist.
Yorkshire, 218 S.E.—Thorpe Stapleton. Original survey by J. C. Ward and R. Russell. Resurveyed by Wilfrid Edwards; C. N. Bromehead, District Geologist.
Yorkshire, 264 S.W.—South Elmsall and Hampole. Original survey by W. T. Aveline and A. H. Green. Resurveyed by G. H. Mitchell; C. N. Bromehead, District Geologist.
Yorkshire, 281 S.E.—Stocksbridge. Original survey by A. H. Green, J. R. Dakyns and J. C. Ward. Resurveyed by Wilfrid Edwards and J. V. Stephens; C. N. Bromehead, District Geologist.
Yorkshire, 284 N.W.—Harlington and High Melton. Original survey by W. T. Aveline and A. H. Green; C. N. Bromehead, District Geologist.

6 inches to 1 mile Maps of London District (Colour-printed):—

London, N.1 N.E. (Middlesex, 11 N.E.).—Finchley. Original survey by C. N. Bromehead. Additional notes by S. Buchan; H. Dewey, District Geologist.
London, N.1 S.E. (Middlesex, 11 S.E.).—Hampstead Heath. Original survey by A. C. G. Cameron; H. B. Woodward, District Surveyor. Resurveyed by C. N. Bromehead. Additional notes by S. Buchan; H. Dewey, District Geologist.
London, N.2 N.W. (Middlesex, 11 N.W.).—Alexandra Park. Original survey by C. N. Bromehead. Modifications and additional notes by S. Buchan; H. Dewey, District Geologist.

London, N.2 S.W. (Middlesex, 12 S.W.).—Upper Holloway. Original survey by A. C. G. Cameron; H. B. Woodward, District Surveyor. Revised by C. N. Bromehead. Modifications and additional notes by S. Buchan; H. Dewey, District Geologist.

London, N.2 S.E. (Middlesex, 12 S.E.; Essex, N.77 S.E.).—Lea Bridge. Original survey by J. A. Howe. Additions by C. N. Bromehead. Modifications and additional notes by S. Buchan; H. Dewey, District Geologist.

London, N.3 N.W. (Essex N.78 N.W.).—South Woodford. Original survey by J. A. Howe and H. G. Dines. Additional notes by H. G. Dines; H. Dewey, District Geologist.

London, N.3 N.E. (Essex N.78 N.E.).—Barkingside. Original survey by J. A. Howe and H. G. Dines. Modifications and additional notes by S. Buchan; H. Dewey, District Geologist.

London, N.4 N.W. (Middlesex, 16 N.W.).—Harlesden. Original survey by A. C. G. Cameron; H. B. Woodward, District Geologist. Revised by C. N. Bromehead. Additional notes by F. B. A. Welch; H. Dewey, District Geologist.

London, N.4 N.E. (Middlesex, 16 N.E.).—Maida Vale. Original survey by A. C. G. Cameron; H. B. Woodward, District Surveyor. Revised by C. N. Bromehead. Additional notes by F. B. A. Welch; H. Dewey, District Geologist.

London, N.4 S.W. (Middlesex, 16 S.W.).—Acton. Original survey by A. C. G. Cameron; H. B. Woodward, District Surveyor. Resurveyed by J. A. Howe. Additions by C. N. Bromehead, H. G. Dines and F. B. A. Welch; H. Dewey, District Geologist.

London, N.4 S.E.—Kensington Gardens. Original survey by A. C. G. Cameron. Alterations and additions by C. N. Bromehead and R. L. Sherlock; H. Dewey, District Geologist.

London, N.6 N.W. (Essex, N.86 N.W.).—West Ham Park. Original survey by C. N. Bromehead. Modifications and additional notes by F. B. A. Welch; H. Dewey, District Geologist.

Scottish Maps published in 1934

¼ inch to 1 mile :—

Sheet 5.—Sutherland, Caithness (West), and Ross and Cromartyshire (North-West).

6 inches to 1 mile (Coalfield maps) :—

Dumfriesshire, 6 S.W.—Sanquhar (W. part). Original survey by B. N. Peach. Revised by J. E. Richey, District Geologist.

Lanarkshire, 8 N.W.—Airdrie. Original survey by J. Geikie. Revised by C. T. Clough. Republished with additional information by J. K. Allan.

Manuscript copies of the following maps on the scale of six inches to one mile were deposited in the Library for public reference. They are not to be published. The English reference maps are deposited in the head office in London. These manuscript copies of unpublished maps may be examined in the Library of the Geological Survey, Exhibition Road, South Kensington, London, S.W.7 on week-days from 10 a.m. to 5 p.m. Copies of them may be obtained at the cost of drawing and colouring, which will be quoted on application to the Superintendent of Maps. Photographs of these maps will also be supplied on the scale of 3 inches to one mile approximately, at the cost of 2*s*. 6*d*. to 4*s*. 6*d*. per quarter-sheet.

The Scottish manuscript copies which are deposited in the office at 18, Grange Terrace, Edinburgh, may on application be forwarded to the London Office for consultation.

Scottish Manuscript Maps Deposited for Reference

Orkney, 95 N.W., N.E., S.W., S.E.; 101 N.W., N.E., S.W., S.E.; 102 N.W., N.E., S.W., S.E.
Argyllshire, 192 N.W., N.E., S.W., S.E.; 193 N.W., N.E., S.W., S.E.; 194 N.W., N.E., S.W., S.E.; 195 N.W., S.W.

List of Maps in the Press at the close of 1934

English Maps in the Press

¼ inch to 1 mile :—

Sheet 1 with 2.—Alnwick, Berwick, etc. (*Solid, new edition*).
Sheet 8.—Flamborough Head and Grimsby (*Solid, new edition*).
Sheet 8.—Flamborough Head and Grimsby (*Drift, new edition*).
Sheet 12.—Louth, Peterborough, Norwich and Yarmouth (*Solid, new edition*).
Sheet 12.—Louth, Peterborough, Norwich and Yarmouth (*Drift, new edition*).
Sheet 23.—Bournemouth, Isle of Wight, Selsey Bill, etc. (*Solid, new edition*).

1 inch to 1 mile :—

Sheet 84.—Wigan (*Solid edition*).
Sheet 84.—Wigan (*Drift edition*).

6 inches to 1 mile (Coalfield maps) **:—**

Cheshire, 11 N.E.
Cumberland, 36 N.E.
Lancashire, 92 S.E.; 93 S.E.; 94 S.W.; 101 N.E.
Northumberland, N.78 S.W.; N.86 N.E.; N.87 N.W.; N.87 S.W.
Yorkshire, 218 S.E.; 219 S.E.; 233 N.W., N.E., S.W., S.E.; 234 N.E., S.W., S.E.; 261 S.E.; 262 S.W.; 263 N.E., S.E.; 264 N.W.; 274 N.W., S.W.; 275 N.E., S.E.; 276 S.W.; 281 N.E.; 283 N.E., S.E.

6 inches to 1 mile Maps of London District (Colour printed) **:—**

London, N.3 S.W., S.E.; N.5 N.W., N.E., S.W.; N.6 N.E., S.W., S.E.; N.8 N.W., N.E.; N.9 N.W.; N.10 N.W., N.E. (with 11 N.E.), S.W., S.E.

Scottish Maps in the Press

1 inch to 1 mile :—

Sheet 15.—Sanquhar (*Solid edition*).
Sheet 15.—Sanquhar (*Drift edition*).
Sheet 17.—Jedburgh (*Solid with Drift edition*).

6 inches to 1 mile (Coalfield maps) **:—**

Fifeshire, 28 N.W.
Lanarkshire, 6 N.E.

Scottish Vertical Sections in the Press at the close of 1934

Sheet 23.—Vertical Sections illustrating the Central Coalfield. Area I.—Kilsyth and Kirkintilloch districts.

Memoirs

Apart from the Annual Report and Summary of Progress only two memoirs have been published during the past year. One of these is the second part of the Economic Geology of the Fife Coalfields, describing Cowdenbeath, Lochgelly and Kirkcaldy. A third volume of this series is in preparation giving an account of the Leven coalfield, and will probably be sent to press in 1935. The manuscript of a memoir on the Sanquhar coalfield is also nearly completed but awaits the drawing of sections and illustrations. A memoir on the Kilsyth coalfield is also being written. These contributions will practically finish the series of descriptive memoirs of the Scottish coalfields based on the new six-inch maps which have been under revision since 1900. The maps themselves with a few exceptions are already published. Some of these economic memoirs are in their second and third editions, and they form a very valuable and exhaustive description of the Scottish coalfields.

At the close of the year several memoirs were in the press. 'The Geology of the Orkneys', by G. V. Wilson and others, gives the first complete account of the geology of that county, and contains valuable chapters on the fossil fishes and fossil plants by specialists on these groups. A Sheet memoir on the Rothbury and Ashington districts in Northumberland is also being printed. It contains an account of the ground covered by two colour-printed maps 9 and 10 issued in 1934.

On numerous occasions representations have been made that the Geological Survey should provide descriptive accounts of British geology which should be more simple and more comprehensive than the ordinary Sheet memoirs. It has been urged that these memoirs are too restricted in the area they describe and often too technical and elaborate in the details given of local geology to interest a wide class of readers who desire to know only the general features of the district in which they are concerned. Most of the memoirs now contain introductory chapters giving a general account of the physiography and geology of the area covered by the Sheet. In these only an elementary knowledge of geology is assumed and an effort is made to satisfy the demands of the non-technical public. These chapters, however, must of necessity contain only the briefest references to districts outside the region under consideration and, as the area of an English New Series Sheet is only 216 square miles, it is impossible to give a general account of a province or of a geological formation.

In the new Museum the exhibition of British Geology has been arranged in such a way that the country has been divided into eighteen districts each having certain geological characteristics and forming in a real sense a geological and also a geographical province of a distinctive type. To each of these regions a separate division of the first gallery or of the main floor of the Museum has been assigned, where maps, photographs, diagrams, sections,

rocks, fossils, minerals and economic products of that province will be displayed. This seems to be in accordance with the methods of work of the Geological Survey which place special emphasis on the local developments and distribution of the geological formations and their connexion with scenery, physiography and industry in the different parts of Britain. The student of geology who wishes to avail himself of the results of the Survey's work practically always approaches the subject from a local standpoint, and has some special district or group of rocks which interest him primarily.

The officers who have been preparing these exhibits have a good knowledge of the districts they are meant to illustrate and have made an exhaustive study of their special characteristics. In order to render the exhibits more intelligible to visitors it seemed advisable to prepare descriptive handbooks which would serve as guides. Each of the British regions has been assigned to one or more experienced geologists, who have arranged the exhibition, and have also written a handbook on the geology of the area with the general title of ' British Regional Geology.' At the same time it seemed opportune to make these handbooks serve as an introduction to the special memoirs which are published on the geology of each Sheet of the geological map. They will thus have two purposes : on the one hand they will be useful and in fact indispensable descriptive guides to the exhibits of British geology in the new Museum ; and on the other hand they will serve as compendious summaries of local geology which will be less detailed and more general than the special Sheet memoirs. It is anticipated that they will be welcomed by students of British geology and will be of interest to tourists and others who are not specialists, and wish only to learn the broad geological features and general structures of any British district.

The areas or regions into which Britain has been divided for the purpose of description in these handbooks have as far as possible been chosen to contain a marked development of certain geological formations and types of scenery and physiography. Thus for example, Scotland has been divided into five provinces, *viz.* The Northern Highlands, The Grampian Highlands, The Midland Valley, The Southern Uplands and The Tertiary Volcanic areas. Each of these forms a geological and geographical unit, fairly well defined, and with characteristics of its own. In England the same method has been adopted, though the provinces are perhaps not so clearly individualized. Such regions, for example, as London and the Thames Valley, The Weald, East Anglia, The Welsh Borderland and The Pennines are sufficiently distinct to have peculiarities which render them suitable for separate description.

It is intended that this series of handbooks shall be well illustrated with sketch-maps, diagrams and sections, and with plates showing the characteristic or notable types of scenery in each province. A short bibliography is contained in each volume, and

though the amount of descriptive matter must necessarily vary with the complexity of the area described, the aim of the authors is to combine brevity with all the necessary detail for a general comprehension of the subject.

Of these handbooks of British Regional Geology the following were in the press at the close of the year :

London and Thames Valley by Dr. R. L. Sherlock.
The Wealden District by Mr. F. H. Edmunds.
Bristol and Gloucester District by Dr. F. B. A. Welch and Dr. R. Crookall.
The Tertiary Volcanic Districts (Scotland) by Dr. J. E. Richey.

In addition to these the manuscripts and illustrations of several others were shortly going to press. They may be published in 1935 :

The Welsh Borders by Dr. R. W. Pocock and Mr. T. H. Whitehead.
Northern England by Mr. T. Eastwood.
North Wales by Dr. Bernard Smith and Professor T. N. George.
The South-West of England by Mr. H. Dewey.
The Southern Uplands of Scotland by Dr. John Pringle.
The Midland Valley (Scotland) by Dr. M. Macgregor and Mr. A. G. MacGregor.
The Grampian Highlands (Scotland) by Professor H. H. Read.
The Northern Highlands (Scotland) by Dr. J. Phemister.

Other memoirs of this Series which are projected but not yet written are :

The Hampshire Basin
East Anglian District
Central England
The Pennines and Adjacent Areas.
East Yorkshire and Lincolnshire
South Wales.

One of the publications which deserves mention in this place is the ' Guide to the Ardnamurchan Model', which appears in the list on p. 21.

This model was originally constructed for exhibition in the Royal Scottish Museum and shows the complicated geology of the denuded Ardnamurchan volcano on the scale of four inches to one mile. This district is famous as the best known example of the ' ring-structures ' of the Tertiary volcanoes of Scotland, and the model brings out clearly the relations of the geological structure to the surface-relief. A copy of this model will form one of the exhibits on the main floor of the new Museum in London and will undoubtedly attract much attention. The descriptive guide is illustrated with a very full series of sections and sketch maps, and forms a readable handbook to the remarkably interesting geological features of this extinct volcano. The handbook will serve also as an introduction to the Memoir, which was published in 1930, and formed a notable addition to the geological literature of the Tertiary volcanic province of the west of Scotland.

Water Supply Memoirs

No addition has been made during the year to the series of Water supply Memoirs but one volume is in the press, 'The Wells and Springs of Herefordshire' by Mr. L. Richardson. Although it has been impossible, owing to pressure of other work, to give much time to water-supply memoirs, the past year has been an exceptionally busy one in the investigation of problems of this nature. The long continued drought which prevailed in the south and east of England occasioned a very large influx of questions on underground water-supplies. Many of these were of a comparatively simple nature but others involved much research and study, both of the local records in our possession, and of the geological features which have a bearing on the problems of underground water resources. Not only at headquarters in London, but also in the branch offices, this work has taken up much time; in fact, in London, one or two experienced field officers have been nearly wholly employed in these investigations. Questions of this nature are always referred to the officer who has most local knowledge of the district, as the conditions vary so much from place to place.

The list of memoirs published and in the press during the year is given below:—

English Memoirs Published in 1934

List of Memoirs, Maps, Sections, etc. Published by the Geological Survey of Great Britain and the Museum of Practical Geology to 31st December, 1934. Price 1*s. net.*

Summary of Progress of the Geological Survey of Great Britain and the Museum of Practical Geology for the year 1933:—

Part I.—With Report of the Geological Survey Board and Report of the Director. 93 pp. 1934. Price 1*s.* 6*d. net.*

Part II.—108 pp., 8 plates, 23 text-figuress. 1934. Price 3*s. net.*

Scottish Memoirs Published in 1934

List of Memoirs, Maps, Sections, etc. *See above.*

Summary of Progress. *See above.*

Guide to the Geological Model of Ardnamurchan. By J. E. Richey, M.C., B.A. 49 pp., 9 plates, 26 text-figures. 1934. Price 1*s. net.*

The Economic Geology of the Fife Coalfields.

Area II.—Cowdenbeath and Central Fife, including Fordell, Lochgelly, Cadham and Kirkcaldy. By J. K. Allan, M.A., B.Sc. and J. Knox, B.Sc. 207 pp., 2 plates, 14 text-figures. 1934. Price 4*s. net.*

English Memoirs in the Press at the Close of 1934

Wells and Springs of Herefordshire.

Geology of the Country around Rothbury, Amble and Ashington. (Explanation of one-inch Sheets 9 and 10: England and Wales).

British Regional Geology:—

Bristol and Gloucester District.

London and Thames Valley.

The Wealden District.

Scottish Memoirs in the Press at the Close of 1934

The Geology of the Orkneys.
British Regional Geology:—
The Tertiary Volcanic Districts.

Shafts, Sinkings and Borings

Under the Mining Industry Act of 1926 all borings and sinkings for minerals in Great Britain, that are expected to exceed 100 feet in depth, have to be reported to the Director of the Geological Survey of Great Britain.

Two officers, Mr. Templeman in London and Mr. Manson in Edinburgh, are wholly engaged in keeping the records of borings in order, and in visiting and checking the logs of shafts and borings in progress. They also collect specimens, where that seems advisable, and report to the geologists and palaeontologists any new information that seems likely to be of interest, so that fuller investigation can be made if it is considered worth while.

It is not necessary at present to send in notification of borings for water, but, by the kindness of many engineers, borers and others, we obtain information of many such borings that are in progress and the opportunity of visiting them and securing an accurate record is never neglected, if time is available for the work.

During the past year, Mr. Templeman has supervised the transfer of bore specimens from storage at Jermyn Street to South Kensington, and rearranged them in new trays. He has dealt with and reported upon specimens collected in the field and attended to enquiries for specimens and records. An important part of his work now consists in copying out details of records from the correspondence files for the collection of County Wells, and entering the sites upon maps; or in visiting the offices of boring firms to examine their records with the same end in view.

In 1934 he collected from 22 notified borings and shafts: 1 for oil, 8 for coal and 13 for gypsum. In addition he inspected 8 borings for water.

Borings in South Wales gave useful information about the Lower Coal Series, and a shaft sunk in the Forest of Dean (examined also by Dr. Trotter) struck the Coleford High Delf Seam, 7 ft. thick. In underground bores at Chislet Colliery, Kent Coalfield, Mr. Templeman again found the non-marine lamellibranch fauna (referred to last year) that indicates a low horizon in the Middle Coal Measures.

Two recent borings in the Chellaston area (Derbyshire) have reached the Upper Palaeozoic floor beneath the Keuper.

In a boring at Etton Waterworks, Peterborough, the Northamptonshire Ironstone was noted by Mr. Templeman to be overlain directly by a few feet of beds lithologically comparable with the Collyweston Slate; whilst a boring at Whitehaven, Cumberland, yielded important and interesting evidence in the shape of goniatites and other fossils.

An unusual number of other bores, mainly made for water because of the drought, have been visited by the field geologists in different parts of the country, and many of these have added to our knowledge of the underground geology.

Between Thirsk and Boroughbridge bores of this kind have enabled a more accurate boundary line to be drawn between the Keuper Marls and Sandstone beneath the Drift south of the Gilling fault-trough, and the accuracy of the mapping of those faults, where they cross the River Swale, has been confirmed. In the Millstone Grit north of Leeds, Mr. Edwards examined two bores of interest. One at Sicklinghall Waterworks yielded a marine band above the Cayton Gill Beds, at the base of the R_1 Zone, which has also been recorded by Dr. Hudson near Spofforth Haggs, 2 miles to the south-south-west. The other, at Wetherby Waterworks, gave a marine band at a somewhat higher horizon. Borings in the Yorkshire Coalfield have proved *Carbonicola* bands and a *Lingula* band of some value.

In the Vale of Marshwood, Dorset, Dr. Welch studied borings that proved, or afforded valuable checks to, the interpretation of the local sequence in the Lower Lias. Another bore gave evidence of a large north-south fault; whilst a well-digging showed that the Gault, a grey sandy clay with typical fossils, which in the Beaminster area farther to the east and south-east is 30-40 ft. thick, has been reduced to 15 feet.

Beside a number of local borings for water examined by the geologists of the Lancashire unit, three were visited in North Wales. In one of these at Abbey Mills, Holywell, Dr. Wright and Mr. R. C. B. Jones identified *Gastrioceras cumbriense* and other goniatites at lower levels, and so fixed the horizon in the Holywell Shales. Mr. Jones also studied a notified boring for coal at Park Collieries, Garswood Park. This passes through Permo-Triassic rocks and Ardwick Beds, into the Middle Coal Measures.

In the south-east of England the accumulation of records both old and new has progressed steadily. Most outside requests to us for geological information lead to our acquisition of further new information, either arising from the correspondence or as a result of operations that may follow the enquiries. It has been possible to show some of this upon the new series of colour-printed geological maps of the London District. Mr. Edmunds studied the cores of a bore at Bushey which passed through the Gault into the old rocks of the Palaeozoic floor beneath the London area.

From Lincolnshire and East Anglia, Mr. Dinham has gathered many new facts; whilst in Cambridgeshire and adjoining counties about 50 borings for water, as well as a number of shallow wells were visited by Mr. Dixon, who has been on field work in that district. The great majority were for supplies from the Chalk and Lower Greensand and were uniformly successful. On the other

hand those in Jurassic rocks, whether clays, limestones or sandstones, were as uniformly unsuccessful. The few borings and wells in gravels were only partly successful.

A group of borings and wells at Podington and Hinwick near Rushden affords information about a district which appears from the old geological map to be underlain entirely by Great Oolite Limestone and Chalky Boulder Clay. Upper Lias forms the bottom of the valley of the Hinwick brook as far south at least as Hinwick House, and it is overlain by Upper Estuarine Series and Great Oolite Limestone above an unexposed interval so small that the Northampton Ironstone, which intervenes in workable quantity at Wollaston only 2 miles to the north-west, must be thin or entirely overlapped. As elsewhere, the limestone has failed as a source of water, but a supply has been found in gravel and sand, probably Late Glacial, locally deposited in the valley.

Two wells at Needingworth Ferry proved Elsworth Rock underlying Ouse valley-gravel directly. The limestone was found by Mr. Dewar to be of two types, one almost composed of *Serpula* and other fossils.

In a boring at Clophill the Lower Greensand includes 7 ft. of ' hard blue clay ' at 60 ft. from the surface, much, if not all, of which is fullers' earth. Beds of grey running sand which have not been noticed from this formation north-east of Sandy, suggest material from the same source that supplied the well-known sands in the Leighton Buzzard Greensand.

Two borings to the Lower Greensand in the drift-capped plateau north of the Rhee valley have proved the existence of an unsuspected buried channel, the one with 190 ft. of Chalky Boulder Clay without a break, and the other 220 ft., apparently similar. ' Solid ' rock was reached at 65 ft. and 45 ft. O.D. respectively.

In Chalky Boulder Clay north-west of St. Ives a mass of chalk, 20 ft. thick, was pierced by a well.

At Earith, 5 miles north-east of St. Ives, the low gravel-terrace of the Ouse valley has been found in a group of borings to include plant-bearing clay and shelly sand. The terrace as a whole is probably Late Glacial and it is hoped that the material collected will afford evidence of the climatic conditions.

Boring for gypsum has been actively prosecuted in the Keuper areas of the Midlands about Chellaston and in the New Red Sandstone Series of Cumberland and Westmorland. In the latter areas exploration has been carried out near known deposits—in the Whitehaven area, the Cocklakes area south-east of Carlisle, and near Kirkby Thore, Westmorland. At Cocklakes the results have confirmed the main conclusions reached during the recent re-survey and have added to our knowledge of the local geological succession, more particularly of the beds at and near the junction of the Penrith Sandstone (' Permian ') and St. Bees Shales (' Trias '). About Kirkby Thore there is a thick blanket of boulder-clay, and it is not surprising that the extensive suite of borings put down

there recently has shown that considerable modifications are needed in the boundaries laid down on the old maps.

In Scotland mining and boring operations in search of minerals, chiefly coal and oil-shale, have been particularly active during the year, and under Section 23 of the Mining Industry Act (1926) 42 notifications have been received in the Scottish office. Most of these notifications have referred to borings, and in some instances to the commencement of a series. The inspection of borings, shafts and mines has been mainly carried out by Mr. Manson, though in some cases bores have also been visited by officers concerned with the mapping of areas where such operations were in progress. Access to the journals of bores has been freely granted by mining engineers and the sites of new bores, mines and shafts, have been carefully recorded on the six-inch working maps. The important work of preparing graphic sections from journals has been kept well forward and many enquiries from mining companies in connexion with bores and mines have been dealt with. In frequent instances these inquiries have necessitated the examination and measuring of sections of strata exposed in trial mines in collieries.

A feature of the boring operations carried out in Scotland during the year has been the completion of two deep bores in West Fife on the eastern margin of the great syncline of the Clackmannan Coalfield. These bores have supplied a detailed record of the strata from a position near the top of the Upper Limestone Series down to the lower beds of the Limestone Coal Group. Much useful information has been acquired and important suites of fossils obtained from the cores.

From a bore recently commenced north of the River Forth, and on the western side of the syncline already referred to, a specimen of the zonal fossil *Tylonautilus nodiferus* (Armstrong) has been collected from a bed of fossiliferous shale associated with a thin post of limestone near the base of the Millstone Grit. The horizon is probably that of No. 0 Marine Band which falls within Zone E of Mr. W. S. Bisat's goniatite classification.[1] It is worthy of note that *T. nodiferus* has also been recorded from the same stratigraphical horizon in Carnock No. 3 or Bullions bore,[2] south of the River Forth and some four miles south of the site of the present record.

Water Supply

The prolonged drought of 1934, following upon a marked deficiency in the rainfall of the preceding year gave rise to periods of little or no surface run-off—when the water supplies of large tracts of England and Wales were (apart from rivers, lakes and large storage reservoirs) dependent entirely upon underground

[1] See 'Economic Geology of the Stirling and Clackmannan Coalfield' (*Mem. Geol. Surv.* 1932, p. 114 (footnote 3).

[2] *Ibid.*, p. 117.

sources. Again, the flows of the streams and rivers themselves were maintained at such times by waters that issued from underground as springs.

The effect of the drought, again, was evident in the depletion or drying-up of many of these springs, by the lowering of water-tables in the pervious rocks, and by the falling off in hydrostatic pressure (head) in sub-artesian and artesian wells.

This led to an increase in the number of enquiries received from Consultants, Engineers, Public Bodies, and others as to local or regional geological conditions in these circumstances, and many problems of a novel kind were raised. In some cases it was possible to furnish particulars, from our ever-increasing records and experience, which made the solution of the difficulty fairly clear, but in other cases there appeared to be no remedy short of leading water from a considerable distance, or a return to a normal rainfall, or even, perhaps, the occurrence of an abnormal one.

The demand upon the time of the staff, although heavy, was compensated by the acquisition of valuable geological information (in the form of records, fossils and rock specimens) much of which might not have come to light for years. At the same time it was satisfactory to be in a position to help those who were in urgent need of new supplies.

To cite only one group of successes: several wells in different parts of the South of England that had penetrated all the Upper Chalk and had run dry were sunk through the Middle and Lower Chalk to the Upper Greensand, and new supplies obtained. Others commencing in the Lower Chalk were carried down to the Lower Greensand in districts where the Upper Greensand is wanting. Water derived from sandy and gravelly surface (drift) deposits, or from small outliers of pervious rock overlying clay formations, tended generally to diminish or even fail altogether: such cases were more difficult to treat, but by boring through the clay to a pervious bed satisfactory supplies were sometimes obtained.

In addition to this, as in former years, a number of proposals for local or district water-supply schemes, that involved special geological conditions, were submitted by the Ministry of Health to the Survey for consideration and report.

The Assistant Director (Dr. Bernard Smith), with other members of the Department of Scientific and Industrial Research, attended two informal Meetings at the Ministry of Health in connexion with questions of water-supplies.

At the meeting of the British Association in Aberdeen a special discussion of water-supply problems was held in the Geology Section. The Director and Mr. L. H. Tonks of the Manchester unit took part in this discussion and explained the operations of the Geological Survey. Dr. Bernard Smith is a member of the British Association Committee, representing the Geological Survey. He also acts as an assessor to a committee appointed by the Ministry of Health on Inland Water Supply, and has assisted in

drafting a questionnaire on underground supplies for circulation by this committee. Dr. Bernard Smith has also been co-opted as a member of the Hydrology Section of the International Union for Geodesy and Geophysics, on which the Director also serves. The growing importance of information on underground sources of water is now widely recognized and it is expected that the Geological Survey will be consulted on this subject in future even more frequently than in the past, and it is important that the information should be, so far as possible, accurate, complete and up-to-date.

Agriculture and Soil Mapping

Following the report of the Soil Survey Conference held on 4th December, 1933, the Ministry of Agriculture and the Department of Agriculture for Scotland reorganized the arrangements for co-ordinating soil survey work in Great Britain. The Soil Survey Conference and its Mapping Sub-committee have been superseded by the Soil Surveyors' Conference, with a standing Executive Committee, the latter replacing the Soil Correlation Committee.

At the request of the Ministry of Agriculture for a member of the Geological Survey staff to sit on the Executive Committee, Mr. H. G. Dines was nominated and the members of the Committee are as follows:—

Prof. G. W. Robinson (*Chairman*)
Mr. W. Morley Davies
Mr. H. G. Dines
Prof. J. A. Hanley
Sir T. H. Middleton
Dr. W. G. Ogg
Dr. T. Wallace

The Soil Surveyors' Conference normally takes the form of field-meetings held annually in districts selected by the Executive Committee. At these meetings agriculturalists actually engaged in soil survey work meet and carry out the survey of an area and discuss and compare progress in the methods used in their respective districts. This enables them to try out their own methods alongside those of others, as well as to examine districts and soils other than their own, and, as a result, to see their own problems from new angles.

The district chosen for the 1934 field-meeting is situated on the Kyloe Hills, near Belford, Northumberland, and in April, the Executive Committee, accompanied by Mr. G. A. Burnett of the Geological Survey Office of the Northumberland District, visited the ground to select a suitable area for survey. The area adopted was about one square mile in extent, comprising both woodland and grassland, situated on Carboniferous sandstones and limestones, Whin Sill and Boulder Clay.

The field-meeting was held at Kyloe Hills from 16th to 21st July, there being 20 members present, including Mr. Dines and

Mr. Burnett, who assisted in geological problems arising out of the survey. Such problems mainly concerned the Boulder Clay deposits, part of which are of northern origin, and therefore composed largely of material foreign to the district, while another subject of discussion was the thin ' feather edges ' of drift deposits not indicated on geological maps, which give rise to soils differing from the ' type soil ' of the underlying solid formation.

As an outcome of the meeting a modification was made in the list of ' Parent Materials ' of British soils (*Summary of Progress for* 1933, Pt. I, *Mem. Geol. Surv.*, 1934, p. 25) in order to form a group to include the Carboniferous sandstones (Fell Sandstone).

On 10th December, 1934, Mr. Dines attended meetings of the Executive Committee and of the Soil Surveyors' Conference held in London. At the former it was agreed to hold the 1935 field-meeting from 8th to 13th April, and at the invitation of Mr. A. Blenkinsop, Advisory Chemist at Seale Hayne Agricultural College, and Mr. J. B. E. Patterson of Dartington Hall, it was decided to select an area at Dartington, near Totnes, Devon. Dr. T. Wallace and Mr. Dines were asked to make the necessary preliminary arrangements in the district.

The Committee decided to recommend the Soil Surveyors' Conference to accept Mr. Dines' modification of the Coarse Yellow Sand group which is now subdivided as follows :—

Yellow Sands	straight *e.g.* Folkestone Beds drift *e.g.* Dune Sand	
Yellow Sandstone	straight *e.g.* Carboniferous Sandstone drift *e.g.* Local Boulder Clay	of Kyloe Hills area

It was agreed that it would be advisable to collect and record details concerning the areas at present surveyed in Great Britain.

At the Soil Surveyors' Conference which followed the above meeting, the work at Belford was reviewed and amongst other things the question of standardization of soil textures was discussed.

Forestry

As in former years, samples of soils submitted by the Forest Products Research Laboratory have been reported on by field geologists, and other information has been given of a special kind, relating chiefly to the character and probable thickness and local extent of the solid rocks or the drift deposits overlying them at sites where the samples were taken.

In this research selected trees are felled and studied in relationship to their environment, important factors in which are the different types of soil or subsoil upon which they have grown, and the possibility of free or impeded drainage.

Building Stones Research

A conference between officers of the Building Research Station and of the Geological Survey and Museum in December was attended by the Director, Dr. B. Smith, Dr. W. F. P. McLintock and Mr. F. H. Edmunds.

In connexion with the problem of stone suitable for the repair of the fabric of the Houses of Parliament, a joint committee of officers of H.M. Office of Works, of the Building Research Station, and of the Geological Survey was set up, Mr. Edmunds being the member appointed from the Geological Survey. Several meetings of this committee have been held, and Mr. Edmunds has also visited a series of quarries in the Inferior Oolite and Great Oolite of Northamptonshire, Rutland, Lincolnshire and the Cotswold Hills. In addition to special information germane to the main object of this enquiry, much of general geological interest was gathered, and the opportunity was taken to secure a series of rocks for the new Museum. In this investigation the officer of the Geological Survey staff is intended to supply particulars of the geological features of the respective sources of stone and, so far as the evidence goes, to indicate the probable resources of each type of material, or to suggest means of exploration to prove the reserves. The stone will be tested at the Building Research Station.

Dr. McLintock represents the Geological Survey and Museum on the Standing Chemical and Weathering Committee of the Building Research Board.

Fuel Research

The officers of the Geological Survey continue to co-operate with the Local Committees of the Physical and Chemical Survey of the National Coal Resources which have been formed under the Fuel Research Board, by providing the geological information required in connexion with their investigations. A Geological Survey representative serves on each local committee of the Fuel Survey and enquiries regarding the nomenclature and correlation of coal seams receive attention at Headquarters and at the Branch Offices. A limited number of enquiries received at the Geological Survey offices are passed on to the local Fuel Survey Offices for investigation and reply. No chemical work is at present being done on fuels in the Geological Survey laboratories as this work has been entirely taken over by the Fuel Survey.

The officers representing the Geological Survey on the various local committees are as follows :—

Scotland	Dr. Murray Macgregor
Northumberland and Durham	Mr. R. G. Carruthers
Cumberland	Mr. T. Eastwood
Yorkshire	Mr. C. E. N. Bromehead
Nottinghamshire and Derbyshire	Mr. C. E. N. Bromehead
Lancashire	Dr. W. B. Wright
North Staffordshire	Dr. B. Smith
Forest of Dean	Mr. T. Eastwood
South Wales	Mr. E. E. L. Dixon

Water Pollution Research

The only branch of this work with which the Geological Survey is directly connected is the investigation which is in progress regarding sedimentation in the Mersey estuary. Dr. W. B. Wright, District Geologist in charge of the Manchester office serves on this committee and gives advice on geological problems. It has been decided that when the Preston Sheet (75) is finished the revision of the Warrington Sheet (84) will be taken in hand, and as this Sheet contains a large area surrounding the Mersey estuary, and draining into it, all necessary information regarding the geological conditions can be specially collected.

Conferences

Dr. Bernard Smith represented the Geological Survey and Museum at the Jubilee celebrations of the Swiss Geological Society in September, and presented a formal address of congratulation. He took part in an excursion to the Alps which was conducted by Professor Collet and Professor Paréjas and which preceded the general meeting.

At the British Association Meeting in Aberdeen in September, the Geological Survey was represented by the Director, and several members of the English and Scottish staffs were present and took part in the discussions.

Dr. Bernard Smith (see p. 26) attended meetings of the British Association Committee on Water Supply and of the Committee of the Ministry of Health on the same subject.

Sir John Flett presided over the celebrations of the Centenary of the Edinburgh Geological Society on September 3rd and 4th, 1934.

Mr. F. E. Edmunds acted as President of the Geological Section of the South Eastern Union of Scientific Societies, and delivered an address on ' Water Supply ' at their Annual Meeting at Reading, in June, 1934.

Mr. C. E. N. Bromehead has been elected President of the Hull Geological Society.

Collaboration

In the preparation and arrangement of exhibits for the new Museum we have received most useful assistance from several former members of the staff. Professor Herbert H. Read, of Liverpool University, has taken in hand the exhibition of maps, diagrams, photographic views and specimens illustrating the geology of the Grampian Highlands of Scotland, a region in which he has done much field work. He has also made a special study of the literature and has prepared a volume of the British Regional Geology descriptive of that province.

Similarly Professor T. N. George of Swansea University has collaborated with Dr. Bernard Smith in the preparation of the

exhibits which illustrate the geology of North Wales, a most complicated and difficult region, in which the one-inch maps of the Survey are almost obsolete. Professor George has also assisted in writing the handbook descriptive of that province and he has given advice regarding the collection of additional specimens needed to bring the series of rocks and fossils up to date.

Mr. L. Richardson has corrected the proof of his memoir on the Wells and Springs of Herefordshire which is passing through the press and nearly ready for publication.

We have received much assistance from British geologists who have most willingly contributed specimens of fossils and rocks to fill the gaps in the new Museum. Among these special mention may be made of Professor Swinnerton (Nottingham), Professor Fearnsides (Sheffield), Professor Gibb (Aberdeen), Professor Innes (St. Andrews), Professor Jehu and Dr. Campbell (Edinburgh), and Professor King (London). Many specimens have also been contributed by Foreign and Colonial Geological Surveys and by mining companies, quarry owners and others.

Professor S. H. Reynolds has completed his overhaul of the British Association series of geological photographs, and has deposited the whole collection in our new Library, where special cabinets have been allotted to them and the card catalogue has been placed in a readily accessible position. Every facility can now be given to members of the public who wish to consult this famous collection.

In preparing our new series of British Regional Geology handbooks it has been necessary to make numerous applications to the Geological Society of London and the Geologists' Association for permission to reproduce illustrations from their publications. This has in every case been willingly accorded, and we desire to express our thanks to the Councils of these Societies for their courtesy.

As stated on p. 32 Professor E. J. Garwood, F.R.S., has most generously presented to the Geological Survey a very large part of his great collection of British fossils which illustrate his numerous contributions to British Geology. For Professor Garwood's use a room has been assigned in the new Museum and he has been so good as to superintend the arrangement and registration of this collection.

Miss Odell has devoted a considerable amount of her time to this work. When the registers are completed the specimens will be made readily accessible, not only to officers of the Geological Survey but also to students and specialists who wish to consult the collection.

Miss Tassart has given most useful services in making drawings of typical British fossils to illustrate the handbooks of British Regional Geology.

As in former years the Survey has consulted many eminent specialists in palaeontology and palaeobotany on those groups of

fossils in which they are especially interested. The following names are included in the list:

Prof. D. M. S. Watson, University College, London; Vertebrate fossils.

Miss Gertrude Elles, Newnham College, Cambridge; Graptolites.

Dr. L. F. Spath, British Museum; Ammonites.

Mr. W. S. Bisat, Hull; Goniatites.

Prof. A. E. Trueman, University, Bristol; Carboniferous Mollusca.

Dr. Stanley Smith, University, Bristol; Corals.

Mr. A. G. Davis, London; Tertiary Mollusca.

In the Edinburgh office Dr. E. M. Anderson has completed a Catalogue of the Types and Figured Specimens in the palaeontological collections of the Geological Survey of Scotland.

Mr. L. Richardson is preparing a memoir on the geology of the Witney district, descriptive of Sheet 236.

Palaeontology

England and Wales.—The fossils received during the year numbered 3,968, of which 1,128 specimens were obtained by purchase or donation. The presentations included suites of Cambrian fossils from Comley and Nuneaton, gifted respectively by Dr. E. S. Cobbold and Professor V. C. Illing, and type and other specimens from Carboniferous rocks were received from Mr. W. S. Bisat, Dr. R. G. S. Hudson, Dr. J. W. Jackson, Dr. D. Parkinson and Mr. J. Holmes. Two fine slabs of Grinshill Sandstone showing reptilian footprints and other blocks with reptilian remains were presented by H. J. M. Kilvert-Minor-Adams, Esq., on behalf of the late Miss Catharine A. Kilvert. The collection also includes two finely preserved starfish from the Ludlow Rocks of Leintwardine. Other gifts of fossils are noted in the List of Donations on pp. 40-44.

Special mention, however, should be made of the presentation of a large collection of Carboniferous Limestone fossils by Professor E. J. Garwood, F.R.S. The collection includes the series figured and described in his important paper, ' The Lower Carboniferous Succession in the North-West of England,' and his joint contributions with Miss Edith Goodyear on ' The Lower Carboniferous Succession in the Settle District ' and ' The Geology of the Old Radnor District,' and the extensive series of fossils collected in connexion with the work of the Committee appointed by the British Association to investigate the faunal succession in the Lower Carboniferous (Avonian) of the British Isles.

The removal of the Palaeontological Collections from the museum at Jermyn Street to South Kensington and the re-arrangement of the specimens in new cases in the Reserve and Study Galleries and Crypt was a task that completely overshadowed all the other activities of the department during the year. Prior to

the event preparations had been made by the staff under the able guidance of Dr. F. L. Kitchin, but his sudden death on the eve of the removal, placed a heavy burden on the members of the department.

In the work of assembling palaeontological material required for the regional exhibits a heavy call was also made on the services of the staff. As a result of energetic co-operation considerable progress has now been made, and fossils have been named and labels prepared for most of the exhibits.

Mr. C. P. Chatwin has arranged the specimens for the Hampshire Basin regional exhibit in the museum cases, and has set out nearly all the material for a similar exhibit illustrative of the geology of East Anglia.

In connexion with current Survey work Mr. Chatwin has named Gault and Chalk fossils from localities included in the Cambridge Sheets, and has made a preliminary examination of Jurassic material obtained from the same district. He has also named a set of specimens from a boring at Castleton in Dorset; and has continued the collation of part of the Geological Society's collection previous to registration by Miss Odell.

The services of Dr. C. J. Stubblefield have been directed towards the selection and preparation of labels for the Palaeozoic fossils to be exhibited in the Welsh Border, Midlands, Lancashire and Yorkshire regional cases. He has also named suites of fossils collected by field officers from localities in Sheets 61 (Skipton), 167 (Dudley), 230 (Ammanford), 233 (Monmouth) and 256 (North London).

In addition to the assistance rendered in the preparation of regional exhibits, Mr. S. W. Hester and Mr. W. Dewar have visited numerous borings and wells in several parts of the country, and have made collections of representative rocks and fossils, which have in every instance helped to identify the position of the beds encountered in these undertakings.

Miss M. E. Odell has continued her registration work, and in addition to the Geological Society's collection, she has dealt with a number of specimens recently acquired by purchase.

Mr. S. W. Morgan has been much occupied in preparing, developing and registering specimens for several of the regional exhibits, and with fossils sent out on loan for purposes of study by specialists and other research workers. During the year the number of specimens thus borrowed exceeds 1,100.

SCOTLAND.—Nearly 1,000 specimens were added to the reference-collection in Edinburgh. Much of the material was obtained from borings and shaft-sinkings in the Carboniferous rocks of the Central Coalfield. The remaining portion was collected during the progress of Survey work in Northumberland. The collecting was carried out by Messrs. Manson and Eckford.

In the early part of the year, Dr. J. Pringle named a number of specimens from Northumberland, including a suite of fossils obtained from a boring at Silver Hill (Sheet 19), but much of his

time has been occupied in the work of selecting and naming specimens required for Scottish regional exhibits. He has written a guide to the South of Scotland, and, with the assistance of Mr. R. Eckford, is at present engaged in the preparation of an exhibit designed to illustrate the geology of the region.

Dr. E. M. Anderson has completed a catalogue of types and figured specimens in the Geological Survey Collections, displayed in the Royal Scottish Museum. It contains nearly 900 entries, and is now ready for publication.

The number of specimens sent out on loan to research workers was 159. Although the total is smaller than that of the previous year, the number of approved borrowers has increased; the fossils lent for study are chiefly from the Cambrian and Carboniferous rocks.

Palaeobotany

The bulk of the Palaeobotanist's time has been spent on Museum work and the removal and curating of specimens.

Identifications of fossil plants have been made from 12 one-inch sheets, and 608 plant specimens and 50 micro-preparations have been registered and added to the collections.

Loans of specimens, micro-sections and photographs of fossil plants have been made to Professor W. H. Lang, F.R.S. (Manchester), Dr. M. Benson (Hertford), Dr. E. Dix (London), Professor H. S. Holden (Nottingham), Dr. M. K. Elias (Kansas) and Dr. R. Florin (Stockholm).

During the year Dr. Crookall visited the Lomax Palaeobotanical Laboratories at Bolton and purchased a number of calcareous nodules. From these he has prepared and registered 49 ' cellulose pulls.' In addition, he has made a number of preparations of *Pachytheca*.

Samples of British coals have been sent to the Naturhistorisches Museum, Vienna, and photographs of fossil plants, copies of Museum labels, etc., to a number of workers.

Much work has been done on the ' Bristol and Gloucester District ' and ' Coal ' Exhibits as well as on those portions of other exhibits which include important plant horizons. The account of the Bristol and Gloucester District (British Regional Geology), written in collaboration with Dr. F. B. A. Welch, is now in the press.

Petrography

Apart from enquiries from Government departments, public bodies and private individuals, which have been as numerous as in previous years, the whole activity of the department has concentrated on the move to the new Museum, the arrangement of the registered collections in their new quarters, and the selection and arrangement of material for exhibition.

The Petrographical department was the first section of the Survey and Museum to be transferred to South Kensington, the move commencing in February. Over sixty thousand registered specimens and more than fifty thousand rock-sections were transferred without loss or breakage. They were placed in their permanent new quarters and were rendered immediately available for reference. This work was carried out by Messrs. Andrews, Hepple and T. G. Jones with commendable celerity and care. Mr. Hepple and Mr. Jones also, later in the year, rendered notable assistance to the Palaeontological department for ten weeks, in the packing of fossils prior to their removal from the old to the new Museum.

Miss E. M. Guppy has devoted much time to the registration of Museum rock-specimens, which now number 13,032, of which 2,668 have been added to the registers during the past year.

All specimens that had been on exhibition at the old Museum and a large amount of valuable material from store, hitherto unregistered, have been placed on the registers. There still remains a good deal of unregistered material in store, and the registration of this will be proceeded with as its worth is determined and as time and opportunity allow.

The Petrographer has been called upon to deal with many enquiries of a scientific nature and has been frequently consulted with reference to industrial pulmonary diseases by the Home Office, Mines Department and the Medical Research Council. Most of his time, however, has been fully occupied with the transference of the collections, the organization and equipment of his department, matters of general import connected with the Museum, and in the selection and arrangement of material for petrographical and regional exhibits.

It has not been found necessary to do much rock-collecting during the past year in England and Wales, but in Scotland Messrs. Eckford, Fisher and McCall collected specimens to the number of 629, mainly for the purposes of the Scottish regional exhibits.

In Scotland such petrographical work as was done was chiefly connected with the Museum exhibits, and of this, field officers responsible for the various regional exhibits have taken their share —Dr. Richey in connexion with the West of Scotland, Dr. Phemister for the North-West Highlands, Mr. A. G. MacGregor for the Central Valley and Prof. H. H. Read (formerly an officer of the Survey) for the North-East of Scotland.

Dr. Kennedy, latterly assisted by Mr. Davidson, has arranged exhibits in the Museum illustrative of Vulcanicity and Metamorphism.

Dr. Phemister and Mr. MacGregor reviewed and classified the igneous rocks of one-inch Sheet 15, prior to its publication.

The number of sliced rock-specimens and corresponding sec-

tions registered in the collections and housed for reference in the Petrographical Department in London is as follows:—

English and Welsh	17,065
Scottish	30,853
Irish	841
Foreign	4,106
Total ...	52,865

This represents an increase of 1,033 in the registered sliced specimens added during the past year. Of the corresponding sections, 422 were prepared by Messrs. Andrews and Hepple in the London office; 215 were registered to be made in Scotland and 396 were presented.

Presentations to the department consist of a most interesting series of rock-specimens from Korea, with 395 corresponding rock-sections presented by Mr. T. C. Hall, some large specimens from the Malvern Hills by Dr. A. Brammall, a suite of rocks from the granodiorite and associated masses of Crathie, Aberdeenshire, by Dr. Claringbull, and a valuable collection of Derbyshire igneous rocks by Dr. H. H. Bemrose.

During the year Dr. Kennedy has made and published a translation of Dr. Karl Chudoba's book on the determination of the feldspars in thin sections, and with Mr. B. E. Dixon he has published a mineralogical and chemical description of a titaniferous augite from Aberdeenshire in the *Zeitschrift für Krystallographie;* Prof. H. H. Read has published in the *Quarterly Journal of the Geological Society* a paper on the metamorphic geology of Unst in the Shetland Islands, based upon his Survey work. Mr. E. M. Anderson, until lately a member of the Scottish staff, contributed a paper on 'Earth Contraction and Mountain-building' to the *Gerlands Beiträge zur Geophysik* and Dr. Phemister published a paper in the *Mineralogical Magazine* on the zoning of plagioclase feldspar.

Photography

ENGLAND AND WALES.—In spite of the transference to the new offices, and the preparation and equipment of new dark-rooms causing an unavoidable break in the programme of work, a very great deal of photographic work has been carried out by Mr. Rhodes during the past year. All of it has been intimately connected with the Museum exhibits.

Mr. Rhodes had a short field-season only, working in Kent, Buckinghamshire, Gloucestershire, Devonshire, Dorset and North Wales, followed by a short period in the Brighton district. He added, during this time, 171 negatives to the collection of English and Welsh geological views.

Most of the year was occupied with indoor work involving the production of negatives as follows:—Miscellaneous negatives 501, Photomicrographs 6, and new negatives made from old plates by means of recently acquired apparatus 78. Lantern slides were made to the number of 116, of which 73 were in response to outside orders

from the public. The number of negatives registered to date is as follows:—

English Photographs	6,528
Photomicrographs	2,193
Miscellaneous Photographs	3,215
Total ...	11,936

Printing has been unusually heavy. Direct prints to the number of 1,367 were made, mainly for Museum exhibits and for the English and Scottish Albums. Outside orders accounted for 211.

Enlargements were made to the number of 333. Except for 14 made in fulfilment of outside orders and a small number for artists use and for publication in Museum guides, all were for exhibition purposes, 82 being sepia-tones.

SCOTLAND.—The number of photographs taken during the year is 71. The registered negatives in the Scottish Collection were:—

Whole-plate Scottish Photographs	933
Half-plate Scottish Photographs	3,553
Photomicrographs	38
Total ...	4,524

Lantern-slides have been made to the number of 455, of which 282 were outside orders, and 173 for Scottish Loan Collection.

Contact-prints to the number of 516 have been prepared from Survey negatives. Of these, 118 were for outside orders, 164 for incorporation in the Survey albums, 134 for exhibition purposes, and 100 extra prints for miscellaneous use.

Chemistry

The number of analyses registered in this Department's records at the end of 1934, is as follows:—

English	365
Scottish	603
Irish	2
Welsh	55
Others	53
Total	1,078

Of these, nineteen have been completed during the year and six are still in progress. Twenty-eight qualitative analyses have been carried out for Survey officers and numerous enquiries from various sources have been dealt with. Removal of the Jermyn Street laboratory to its new quarters was commenced early in January, and at the end of March the new chemical laboratory was in complete working order. Mr. C. O. Harvey, B.Sc. (LOND.), A.R.C.S., A.I.C., was transferred from the Government Laboratory on the 14th May to the Geological Survey Laboratory.

The Museum

During the past year the Museum Staff has been occupied almost entirely with the transference of the collections, Library and

Offices to the new building at South Kensington. A start was made in January with the removal of the main part of the Geological Survey staff and the Drawing Office. Thereafter the collections were moved in stages as and when the furniture for their reception was delivered and installed by H.M. Office of Works in the new Museum. The work progressed steadily and without accident, and by 11th October the accumulations of one hundred years, aggregating several hundreds of thousands of specimens, had been safely transferred.

Prior to the removal, a considerable amount of preliminary selection of material for exhibition in the new galleries had been accomplished and it was possible during the removal to separate in some measure material destined for display from that allocated to the Reserve and Study Collections and to Basement Storage. The Reserve and Study Collections are now in preliminary order. They are housed in cabinets in two long well-lighted galleries on the top floor of the Museum. In all about 5,000 drawers have been filled with picked material, minerals, rocks and fossils, and suitable accommodation is now available for students and research-workers to study these valuable collections.

Some delay occurred in the provision of the equipment for the Basement Stores but by September the work was completed and the collections transferred. For their accommodation the central area of the basement has been enclosed by a steel partition. The space so enclosed has been fitted from floor to ceiling with steel racks and wooden drawers of simple construction. A steel mezzanine floor has been installed throughout and a provision of 10,000 drawers to meet present requirements has been made.

The work of setting out the exhibited collections in the new Museum has been steadily advanced since the completion of the transfer. The cases specially designed with curved, non-reflecting glass for the display of precious and semi-precious stones have been installed on the ground floor and the specimens, over 2,000 in number, arranged and labelled. Seven dioramas illustrating subjects of geological and economic interest have been put in position; five more have been delivered and await the arrival of cases, whilst four additional subjects are at present in the hands of the artists and will shortly be completed.

The ground floor exhibits illustrating the general principles of geology are well-advanced. A comprehensive series of Geological Survey photographs supplemented, where necessary, by foreign photographs of such subjects as active volcanoes and modern glaciers, has been assembled and is being set out on the exhibition screens. The appropriate illustrative specimens have been selected from the general collections and are in process of arrangement in the display cases.

The exhibits illustrating the Regional Geology of Great Britain are now well advanced. It will be recalled (*Summary of Progress* for 1931, Part I, p. 8) that for this purpose the country has been

divided into 18 districts, each one illustrated by a display of geological specimens, photographs, maps, diagrams and labels. Of these districts four, namely, London and Thames Valley, the Weald, the Hampshire Basin, and the Tertiary Volcanic District, are illustrated for convenience on the ground floor, the remaining fourteen exhibits being set out on the first gallery. Several of the exhibits are now practically completed and sufficient progress has been made with the others to justify the hope that they may be in order before the opening of the Museum to the public in the summer of 1935.

The arrangement of the collections illustrating Economic Geology and Mineralogy on the second gallery has steadily progressed. The opportunity has been taken to reorganize these collections completely so that they may illustrate as far as possible the main sources of the metallic and non-metallic minerals of commercial importance and the paragenesis of the principal occurrences. For this purpose the gallery containing the main mineral collections has been divided into sections corresponding with the principal metals, tin, copper, iron, lead, etc., and the non-metallic minerals. Within each section the arrangement is topographical. Thus the student working on the paragenesis of the copper minerals will find at hand a series of exhibits illustrating the principal types of copper deposits, their contacts, enrichment, and weathering products.

The main economic series occupies the two sides of the second floor gallery; there are seven standard desk cases in each bay and in the centre is an island case for large specimens. The bays at the eastern end of the gallery are being devoted to such subjects as the structure of lodes, the geology of oil, and the topographical collection of British minerals. The space at the western end is being occupied by the fine collection of building stones, now arranged and labelled, and by exhibits of road-stones, slates, clays, abrasives, refractories, etc.

The work outlined above involves the arrangement of 287 standard desk cases, 22 special cases for precious stones, 28 island cases, and the provision of approximately 1,000 photographs. The labelling so far accomplished has entailed the printing of approximately 13,000 items. At the present rate of progress the contract with H.M. Stationery Office for the provision of printed labels for the exhibited collections should be well advanced towards completion during the coming year.

The Library

The Library at Jermyn Street was closed to the public on 23rd July until which date it had been functioning normally, and the removal of the books began three days later. Approximately 50,000 volumes, 22,000 maps, 25,000 pamphlets, 12,000 geological photographs and lantern slides, together with library furniture,

amounting in all to about 50 tons in weight, were involved in the transference, which was completed on 4th August.

The library in the new building comprises (a) the Main Library and Reading Room, (b) the Small Library, (c) Basement Stores, and the new accommodation has made possible a reorganization of the Library which was considerably overdue.

In the Main Library are now housed (1) Surveys Maps on all scales, (2) serial publications for Great Britain, Europe, Asia, Africa and America (*pars*) arranged in alphabetical order of the respective publishing societies or institutions, (3) Survey publications for Great Britain, Europe, Asia, Africa and America (*pars*), (4) the newer and most frequently consulted independent works. The small ante-room, leading to the Ground Floor of the Museum contains the large collection of reprints and the albums of geological photographs both English and Scottish.

The Small Library which has been furnished with the bookcases from Jermyn Street, reconditioned and adapted to the new accommodation, contains (1) older independent works, (2) serial publications of America (*pars*) and Australasia, (3) Survey publications of America (*pars*) and Australasia, (4) British Association collection of geological photographs with catalogue.

The Basement Stores, fitted with open steel shelving, house serials (prior to 1905) and old editions.

After removal, the work of rearranging the Library was complicated by the fact that volumes destined for the Small Library had to be stored temporarily in the Demonstration Room until the reconditioning and installation of the bookcases from Jermyn Street had been completed. Thereafter it was possible to proceed with the press-marking and cataloguing, and the Main Library was made available to the public on 5th November, since when it has been used to an increasing extent by outside readers. Some time must elapse before the very heavy task of press-marking is completed but, meanwhile, it has been found possible to provide a satisfactory service to the staff and to members of the public.

During the period when the Library of the Geological Survey was closed to the public, the Geological Society of London very kindly allowed enquirers to make use of their Library for reference to published Geological Survey maps and memoirs.

List of Donations during the Year 1934

Allan Wood Mining Co.—Suite of specimens illustrating the magnetic iron ore and associated rocks from New Jersey, U.S.A.

Anderson, J. H., Esq.—Part of tusk of Mammoth (*Elephas primigenius* Blumenbach), from the gravel of the Thames bed, off Thames Haven, Essex.

Bairds and Dalmellington, Ltd., Messrs.—Two samples of coal.

Ball, F. M., Esq.—Cassiterite and wolfram from Burma and Malay States.

Bennet, B., Esq.—Amethyst in breccia from Derbyshire.

BISAT, W. S., ESQ., F.G.S.—Fossiliferous core samples from the Upper Lias of the Melton Borehole, North Ferriby, taken at a depth of 430 feet; and a series of Goniatites from the Carboniferous Limestone of Yorkshire, including types and specimens illustrative of his paper in the *Transactions of the Leeds Geological Association,* vol. v., pp. 112-117 and the *Proc. Yorks. Geol. Soc.,* vol. xxii, 1934, pp. 280-309.

BEMROSE, H. H., ESQ., Sc.D., F.G.S.—A suite of Museum specimens, illustrating the Carboniferous igneous rocks of Derbyshire.

BOSWORTH SMITH, MRS. H.—Four cut gemstones, essonite, chrysoberyl, spinel, andalusite.

BOWER, J. G., ESQ.—Cobalt ores from Tazenaght, Morocco.

BRAMMALL, A., ESQ., D.Sc., F.G.S.—Suite of specimens from Malvern to illustrate hybridization.

BRONTING, L. R., ESQ.—Suite of bauxite rocks from Arkansas, U.S.A.

BROOKES, MISS.—One section of stalactite from Cox's Caves, Cheddar.

BURY, H., ESQ., M.A.—A series of palaeolithic flint implements.

COBBOLD, E. S., ESQ., D.Sc., F.G.S.—A suite of Upper Cambrian fossils from the Orusia Shales of Comley Brook, Shropshire; and a series of Cambrian Trilobites, including species of *Pagetia, Protolenus, Eodiscus* and a paratype of *Strettonia comleyensis* Cobbold, from the Comley Limestones of Shropshire.

CLARINGBULL, G. F., ESQ., Ph.D.—Suite of specimens of diorite, appinite, granite, etc., from Crathie, Aberdeenshire to illustrate contamination; some analysed.

COLONNA, E., ESQ.—' Fairy stones ' from the Connecticut River, U.S.A.

COON, J., ESQ.—Gilbertite with tourmaline, quartz with fluorspar, etc., from Cornwall.

CYPRUS MINES CORPORATION, THE.—Series illustrating the pyrites and associated rocks and minerals from Skouriotissa Mine, Cyprus.

DABELL, C., ESQ.—Oil-bearing limestone from the Sinai Peninsula.

DEWAR, W., ESQ.—Specimen of *Ammonites multicostatus* J. de C. Sowerby, from the Lower Lias of Watchet, Somerset.

EDMUNDS, F. H., ESQ., M.A., F.G.S.—Three examples of *Belemnites* from the Oxford Clay of Fletton, near Peterborough.

FLETT, SIR JOHN, K.B.E., F.R.S.—Chromite from British Columbia, Quebec and Shetland.

FUEL RESEARCH STATION (Dept. Scientific & Indus. Research, *per* A. Maries, Esq., B.Sc.).—Four sections and two samples of coal.

GARWOOD, PROFESSOR E. J., M.A., Sc.D., F.R.S.—A large selection of choice Carboniferous Limestone fossils, including the series figured and described in his classical paper ' The Lower Carboniferous Succession in the North-west of England,' *Quart. Journ. Geol. Soc.,* vol. lxviii; and collections made in conjunction with Miss Edith Goodyear on ' The Lower Carboniferous Succession in the Settle District ' and ' The Geology of the Old Radnor District '; also an extensive series of fossils collected in connexion with the work of the committee appointed by the British Association to investigate the Faunal Succession in the Lower Carboniferous (Avonian) of the British Isles.

GEOLOGICAL SURVEY OF MISSOURI.—Series illustrating refractory clays from Missouri, U.S.A.

GEOLOGICAL SURVEY OF UGANDA.—Tinstone from Mwirasando Mine and other localities in Uganda.

GOLD COAST GEOLOGICAL SURVEY.—Suite of specimens of bauxite, manganese ores and associated rocks from the Gold Coast.

GOTHAM CO., LTD., THE.—Series of specimens of gypsum from Cropwell Bishop Mines, Nottinghamshire.

GRIFFITHS, MAJOR JOWERTH, (Penrhyn Quarries, Bethesda). Slate with pebble.

GYPSUM MINES, LTD., THE.—A series of cements and plasters.

HALL, T. C., ESQ.—Extensive suite of specimens and 395 corresponding rock sections from the Korea, accompanied by locality maps and descriptions.

HOBLEY, C. W., ESQ., C.M.G., A.M.INST.C.E., F.G.S.—An unrecorded Gastropod from the Blackdown Beds of Devon; and a canaliculated Belemnite from the Inferior Oolite of Burton Bradstock; also a specimen of *Gyropleura sp.* from the Chloritic Marl of Mere, Dorset, and gem gravel concentrates from Burma.

HOLMES, J., ESQ.—A series of Goniatites from the Carboniferous Limestone of Yorkshire including types and specimens illustrative of W. S. Bisat's paper in the *Proceedings of the Yorkshire Geological Society*, vol. xxii, pp. 280-309.

HUDSON, R. G. S., ESQ., D.Sc., F.G.S.—A series of silicified shells, including figured specimens of *Airtonia hudsoni* Cope, from the C_2 subzone of Airton Green, near Settle; and a series of Goniatites from the Carboniferous Limestone of Yorkshire, including types and figured specimens illustrative of papers by W. S. Bisat in *Proc. Yorks. Geol. Soc.*, vol. xx, pp. 40-124 and vol. xxii, pp. 280-309 and *Trans. Leeds Geol. Assoc.*, vol. v, pp. 112-119.

ILLING, PROFESSOR V. C., M.A., F.G.S.—A representative suite of choice Middle Cambrian fossils from the trenches, described in the *Quart. Journ. Geol. Soc.*, vol. lxxi, 1915, at Hartshill Hayes, Nuneaton, Warwickshire.

JACKSON, J. W., ESQ., D.Sc., F.G.S.—A series of Goniatites from the Carboniferous Limestone of Derbyshire, including specimens illustrated in a paper by W. S. Bisat in *Proc. Yorks. Geol. Soc.*, vol. xxii, pp. 280-309.

JOHNSTON, MISS M. S., F.G.S., F.R.G.S., F.Z.S.—A specimen of *Cidaris sp.* from the Upper Chalk of Westcombe Park, Kent, presented in memory of the late Wheatley J. Atkinson, F.G.S. (died 1933, aged 83).

JUNG, DR. H.—Specimens illustrating the occurrence of chamosite and thuringite in iron ore from Schmiedefeld, Thuringia, Germany.

KILVERT, THE LATE MISS CATHARINE (*per* H. J. M. KILVERT-MINOR-ADAMS, ESQ.).—Two slabs of Grinshill Sandstone showing good reptilian footprints, also reptilian remains from the same horizon at Grinshill Quarry, and two Ludlow Starfish from Leintwardine, Shropshire.

KING, PROFESSOR W. B. R., O.B.E., M.A., F.G.S.—A selected collection of Ordovician and Silurian fossils from the North-west part of Yorkshire.

MATHEWS, C., ESQ.—Crystal of corundum from Burma.

MATLEY, C. A., ESQ., D.Sc., F.G.S.—Two specimens of Upper Cambrian Trilobites from Chapel End, near Nuneaton, Warwickshire, including the Holotype of *Agnostus securiger* Lake, ' Brit. Cambrian Trilobites,' *Mon. Pal. Soc.* (1906).

MOORE, E. W. J., ESQ., B.Sc., A.I.C.—Six choice specimens of Goniatites from the Carboniferous of Lancashire and Yorkshire, including *Dimorphoceras splendidum* (Brown) and *Goniatites maximus* Bisat.

NEW, S., ESQ.—Specimen of aramayoite with pyrites from Animas Mine, Bolivia.

OAKLEY, K. P., ESQ., B.Sc.—A specimen of a Theropodous Dinosaur (Humerus) from the Rhaetic of Aust, Gloucestershire; and seven specimens from the Wenlock and Dudley Limestones of Staffordshire and Worcestershire.

OAKLEY SLATE QUARRIES CO., LTD., THE.—Three samples of slate showing how iron pyrites is formed in some slates.

PARKINSON, D. ESQ., B.Sc., PH.D., F.G.S.—A series of Goniatites from the Carboniferous Limestone of Yorkshire and Northern Ireland including types and specimens illustrative of W. S. Bisat's paper in *Proc. Yorks. Geol. Soc.*, vol. xxii, pp. 280-309.

PEASE AND PARTNERS, MESSRS.—Samples of dolomite from Co. Durham.

POCOCK, R. W., ESQ., D.Sc., F.G.S.—Three specimens of *Ostrea bellovacina* Lamarck (two with remains of ligament in position) from the Oldhaven Beds of Beckenham, Kent (referred to in *Proc. Geol. Soc.*, 1914), page 100; a specimen of *Lonsdaleia floriformis* (Martin), from the Carboniferous Limestone, D_2 of Shropshire; three specimens of Petalocrinus Limestone from the Woolhope Area, and a graptolite from the Transition Shales of Haugh Wood, Woolhope, Herefordshire.

PRINGLE, J., ESQ., D.Sc., F.R.S.E., F.G.S.—Two specimens of Lower Gault Ammonites from Billington Crossing Pit, Leighton Buzzard, Bedfordshire.

REYNOLDS, PROFESSOR S. H., Sc.D., F.R.S.—A series of specimens of dolomite from Gloucestershire.

RHODES, J., ESQ.—A series of specimens from the Lower Lias Limestone of Devonshire.

RICHARDSON, L., ESQ., F.R.S.E., F.G.S.—A specimen of a Nautiloid from the so-called Millstone Grit of Tanhouse Quarry, Yate, Gloucestershire.

ROSE, W. C. C., ESQ., M.Sc., F.G.S.—A specimen of astrophyllite from Langesund Fjord, Norway.

SANDERS, B. H., ESQ., M.I.M.M.—Ore and associated rocks from the gold mines of Colombia, a suite of iron ores and rocks from Itabira do Matto Dentro, Minas Geraes, Brazil, and stanniferous pegmatite from Waio, Nigeria.

SHEPPARD, T., ESQ., M.Sc., F.G.S., F.Z.S.—A specimen of *Tylonautilus nodiferus* (Armstrong) from the Nodule Bed in the Millstone Grit at Artle Beck, Cayton, Lancaster.

SIERRA LEONE DEVELOPMENT CO., THE.—A series of specimens, illustrating the haematite-schist, iron-ore and laterite of Sierra Leone.

SMITH, B., ESQ., Sc.D., F.R.S.—Swiss Rocks.—Ultramylonite and metamorphosed limestones.

STAINFORTH, R. M., ESQ.—A choice specimen of *Uintacrinus sp.* from the Upper Cretaceous Marsupites Zone, N. of Danes Dyke, Flamborough Head, Yorkshire.

STEPHENSON CLARKE & CO., MESSRS.—Two samples of metallurgical coke.

TEMPLEMAN, A., ESQ.—A specimen of the alga *Solenopora* cf. *gothlandica* Rothpletz, from the Wenlock Limestone of Dudley Castle, Worcestershire.

TURNER, J. SELWYN, ESQ., B.Sc., F.G.S.—A large Ammonite from the Fuller's Earth of Eypemouth, Dorset; and two specimens and fragments of *Tornoceras simplex* (L. von Buch) from the Upper Devonian, top beds of Lummaton Quarry, Torquay, Devon.

UTAH COPPER CO., THE.—Copper ore in porphyry, with limestone wall rock impregnated with chalcopyrite, from Bingham Canyon, Utah, U.S.A.

VITRIFAN CORPORATION, THE.—Kyanite in matrix, and prepared, California, U.S.A.

WAINWRIGHT & POOLE, LTD., MESSRS.—Transparent crystals of green apatite.

WELCH, F. B. A., ESQ., B.A., PH.D., B.Sc., F.G.S.—A series of microslides and specimens of corals from the Carboniferous of various localities, chiefly from Gloucestershire and Somerset; and a specimen of *Palaeosmilia murchisoni* Edwards and Haime from the D_1 horizon in the neighbourhood of Bristol; also a specimen from the Wenlock Limestone of Dormington Quarries, Herefordshire.

WEYMOUTH, THE RIGHT HON. THE VISCOUNT, M.P.—Two stalactites from Gough's Caves, Cheddar.

WHITE, E. I., ESQ., B.Sc., PH.D., F.G.S.—Nine specimens of Fish remains from the Downtonian of Earnstrey Brook, S.W. of Bridgnorth, Shropshire.

WHITEHOUSE, E., ESQ.—Diamantiferous sand from North Borneo.

WHITTARD, W. F., ESQ., B.Sc., PH.D., A.R.C.Sc., D.I.C., F.G.S.—Two specimens of *Deiphon forbesi* Barrande, cf. var. *dikella* Whittard, from the Upper Valentian Zone of *Monograptus turriculatus* of Shropshire and a choice specimen of the head of a new variety of the Lower Cambrian Trilobite *Atops reticula* Walcott (prepared by the donor) with partial counterpart from the *Eodiscus bellimarginatus* Limestone of Quarry Ridge, Comley, Shropshire.

WILLIAMSON, DR. G.—A suite of specimens of ambrite and gum from New Zealand.

WILLS, PROFESSOR L. J., M.A., Sc.D., F.G.S.—A series of Wenlock Shale fossils, from the Mucklow Hill Boring, near Halesowen, Worcestershire, including a good specimen of *Monograptus priodon* (Bronn); and Cellulose pulls of etched vertical and horizontal sections of *Ptycholopas obturata* Butler [MS] 1933, from the above boring.

JOHN S. FLETT,

Director.

II. DISTRICT REPORTS

(A)—ENGLAND AND WALES

1. SOUTHERN DISTRICT

HENRY DEWEY, District Geologist.
H. G. DINES, A.R.S.M., A.M.INST.C.E., Senior Geologist.
W. LLOYD, B.Sc.
F. H. EDMUNDS, M.A.
S. BUCHAN, B.Sc., PH.D.
F. B. A. WELCH, B.Sc., PH.D. } Geologists.

INDOOR WORK

DURING 1934 Museum work took precedence of surveying and consequently only one geologist was deputed for field work.

Mr. Dewey spent much time in interviews and correspondence, for the greater part relating to water supply, and he and his staff replied during the year to some 700 enquiries; this number is over 200 more than those dealt with last year.

Co-operation with other Government Departments was continued: Mr. Dines attended the Conference of the Soils Correlation Committee at Belford, and reported on the soils submitted by the Forest Products Research Laboratory; Mr. Edmunds served upon a joint committee of the Building Research Board and the Geological Survey that is engaged upon the investigation of the properties of building stones; while numerous reports upon water supply were prepared for the Ministry of Health. Other public bodies consulted the Survey with regard to geological questions affecting engineering problems.

In co-operation with Dr. Welch, Mr. Dewey completed the Museum exhibit of Cornwall and Devon geology, and commenced one illustrating the Pleistocene period. The geological handbook to these two counties—one of the series entitled ' British Regional Geology '—is nearly ready for the press.

Much progress was made with the preparation of the colour-printed six-inch maps of London. Several more have been published and 47 proofs were sent to the Ordnance Survey for engraving or colouring.

Mr. Dines devoted most of the year to the arrangement of Museum cases illustrating the occurrence throughout the world of the ores of tin, copper, iron, tungsten and lead and also of the rare earths.

Mr. Edmunds completed the Museum exhibit of Wealden rocks, and also the geological handbook to the Weald (British Regional Geology). He has made progress with the exhibit of Midlands geology, and in the latter part of the year has been assisted by Mr. K. P. Oakley. Mr. Edmunds lectured to the South-eastern Union of Scientific Societies, and read a paper at the Public Health Congress, on the ' Circulation of Underground Water.' Joint investi-

gations with the Building Research Station and H.M. Office of Works into building stones suitable for use in maintaining the fabric of the Houses of Parliament were carried out. Mr. Edmunds visited many quarries along the outcrop of the Inferior Oolite and a few in the Great Oolite in Northamptonshire, Rutland and Lincolnshire, and also in the Cotteswold Hills. He observed that, while stone from all the quarries in the Inferior Oolite consists of oolitic limestone, there is great variation in type and quality. At some localities rock type appears to be fairly constant and quarries in such areas are likely to possess a large supply of stone; elsewhere it is practically impossible to estimate the reserves, since there are rapid lateral changes in lithology not only from one quarry to another but within an individual quarry.

Mr. Lloyd prepared a map of limestones of commercial value in England and Wales, upon which the sites of the most important quarries or groups of quarries are shown. He visited and reported on some boreholes and the Paignton sewage tunnel.

Dr. Welch completed an exhibit of the geology of the Bristol and Gloucester area, and also the geological handbook, which is in proof.

Dr. Buchan, on his return from the Shetland Isles, continued the preparation of the six-inch geological maps of London. It was considered necessary to indicate on these maps the alluvium and the courses of streams that have been diverted into drains or filled in, and some time was spent in tracing their former courses in London and the suburbs. Such ' buried ' channels are a recurring source of difficulty in road-making and building operations, and the knowledge of their probable occurrence saves time and expense.

Bridport Sheet

Dr. F. B. A. Welch resumed the primary six-inch survey of the Bridport map (Sheet 327). The survey proved more difficult than usual on account of extensive landslips and the thick mantle of cherty drift, derived from the Cretaceous beds of the hill-tops, that tends to fill the valleys and cover the slopes of the hills. Although many hundreds of auger-holes were put down, the drift was often found to be too thick to be penetrable by means of the hand borer; elsewhere, by the samples obtained, the age of the underlying beds was proved. Landslips have locally masked the true structure and led to the appearance of greater thinning of beds than really occurs.

Lias.—The greater part of the ground surveyed consists of Middle and Lower Lias, with outliers of Greensand and Gault on the higher ground. The mapping of Marshwood Vale was facilitated by Dr. W. D. Lang's map and paper.[1]

[1] ' The Lower Lias of Charmouth and the Vale of Marshwood,' *Proc. Geol. Assoc.*, vol. xliii, part 2, 1932, pp. 97-126.

It was found practicable to map three subdivisions of the Lower Lias (1) the Black Ven Marls, (2) the Belemnite Marls and (3) the Green Ammonite Beds. The two series of Marls call for no remark, but the mapping of the Green Ammonite Beds involves a difficulty. Along the coast the limestone bands, 'Three Tiers,' separate the Green Ammonite Beds from the Middle Lias, but they do not seem to be present inland. Further, the Green Ammonite Beds, as a clay formation, thin out in a north-westerly direction, and according to Dr. Lang this thinning is due to overlap by the Middle Lias. The recent survey, however, has demonstrated that the disappearance is largely caused by landslips.

Dr. Welch has proved that the Shell Bed at the top of the Eype Clays does not extend west or north of Pilsdon Barn, and thus no subdivision of the Middle Lias can be made in this district.

Gault.—Though for the most part the Gault is concealed beneath superficial deposits, it has been detected at several places. There appears to be a thinning north-westwards, for at Laymore a well-sinking showed only 15 ft. of blue sandy clay containing fossils; to the south-east it is upwards of 30 feet thick.

Upper Greensand.—It has been found that at 100 feet above the base of the Foxmould the Chert Beds form a prominent hard subdivision that thickens westwards. The Chert Beds by their resistance to weathering give rise to many of the high flat-topped ridges, capped by the Greensand, that are such a characteristic scenic feature of this neighbourhood.

Superficial Deposits.—Dr. Welch has been able to prove the widespread occurrence of the Angular Chert Drift. This deposit attains a thickness of 14 feet and in addition to filling all the valleys of the western part of Sheet 327, it extends up the sides of the valleys as far as the outcrop of the Chert Beds. It is a notable fact, however, that it does not occur in the Marshwood Vale.

Where beds higher than the Chert Beds occur the superficial deposits consist of sandy 'clay-with-flints' mixed with pebbles from Eocene formations.

In the wide basin-shaped area at Wootton Fitzpayne gravels up to 14 feet thick form well-marked terraces.

Landslips.—A conspicuous topographical feature of western Dorset is the occurrence of extensive landslips, especially along the Greensand ridges. The slipped masses form a corrugated surface with clean-cut dip and scarp features and often with marshy tracts when seepages break out. A notable example can be seen in the cirque-like valley at Fishpond Bottom, where a great horseshoe shaped mass of Greensand, Gault and Middle Lias has slipped from the sides of the 'cirque' towards the centre of the valley, leaving a precipitous 'slip-scarp' where it has broken away. A similar example occurs in the Gwyle Valley, near Charmouth, and there are many others.

H. Dewey.

2. WEST MIDLANDS AND CAMBRIDGE DISTRICTS

C. H. Dinham, B.A., District Geologist.
E. E. L. Dixon, B.Sc., A.R.C.S.
R. L. Sherlock, D.Sc., A.R.C.S. } Senior Geologists.
R. W. Pocock, D.Sc.
S. E. Hollingworth, M.A., D.Sc., Geologist.

WHILE equipment of the new Museum continues to have first claim upon the Survey staff, field work has been advanced in each of the districts mentioned above. The exceptional dryness of the season enabled Dr. Sherlock, during the autumn months, to make rapid progress in clayey and largely arable ground, and the first six-inch mapping of the whole of the Biggleswade Sheet (204) is now completed. Mr. Dixon, who had already extended his survey northward into the adjoining Huntingdon Sheet (187), continued work in the country between Cambridge and St. Neots. By personal attention to wells and borings in progress at various places in the surrounding area, he was also able to gather much useful information. This area of unbroken clays is poorly represented among our records of wells, and surface exposures are both meagre and rare; it is only by examining artificial sections at every opportunity that progress can be made in mapping the zones of the Oxford Clay.

Dr. Hollingworth continued the revision, on six-inch maps, of the Droitwich Sheet (182), and surveyed an area between Stourport and Worcester immediately to the west of that previously mapped by Dr. T. N. George. Much of the memoir on the Dudley Sheet (167) had already been written by Mr. Whitehead, and some further progress was made this year by Dr. Pocock.

The second successive year of deficient rainfall in central and eastern England has greatly accentuated the anxieties alike of individuals and of water authorities. Of the enquiries, over 300 in number, that have been dealt with by this unit, by far the most numerous were applications for information on water-supplies. All members of the district staff, with the exception of Mr. Dixon, have spent much time on work in connexion with the new Museum. The regional exhibit illustrating London and the Thames Valley has been almost completed by Dr. Sherlock, and one for the Welsh Borderland by Dr. Pocock in collaboration with Mr. Whitehead; the corresponding guide-books are also practically ready. Dr. Pocock has co-operated in an agricultural survey by the Harper Adams College, Shropshire; and a special map of the chief iron-ore deposits of England and Wales has been compiled by Dr. Sherlock.

Corallian.—In two trial-wells[1] at Over Ferry, near St. Ives, and immediately under the Ouse valley-gravel, Mr. Dewar found the Elsworth Rock to consist partly of ironshot, oolitic limestone, which may be regarded as the ' typical ' Elsworth Rock, and partly of non-oolitic *Serpula*-limestone, with *Exogyra nana,* in contact with, and probably below, the ironshot rock. Both types of limestone were included in the Elsworth Rock, as described by C. B. Wedd[2] at Elsworth and elsewhere from St. Ives to the vicinity of Abbotsley, the *Serpula*-limestone, where present, underlying the other. At Abbotsley, and in stratigraphical continuity with the Elsworth Rock, a *Serpula*-limestone or marl, associated with abundant *Exogyra nana,* with *Ostrea gregaria* and a few other lamellibranchs, has been detected by Mr. Dixon, and followed as far as Tetworth; but no indication of the ironshot rock was observed. The Elsworth Rock, including the *Serpula*-limestone, is a condensed deposit,[3] and its large ammonite-fauna has been found by Dr. Spath to indicate two zones, and to include many species unknown elsewhere in the country. As Dr. Arkell[4] remarks, its members may well be of somewhat different ages in different places.

The *Exogyra nana* beds, formerly regarded as the basement beds of the Ampthill Clay, have now been separated off by Dr. W. J. Arkell under the name of ' Oakley Beds.'[5] Of the Ampthill Clay, as thus restricted, little is now seen, the old pits between Croxton, Gamlingay and Tetworth being overgrown or full of water. A new outcrop, however, has been discovered by Mr. Dixon around Abbotsley, where it forms an outlier capping the *Serpula*-limestone.

Lower Greensand.—The discovery of fullers' earth at Clophill by Mr. Dixon shows that this mineral is not confined to the vicinity of the workings near Woburn Sands. In a boring at Luton,[6] a small fauna of minute lamellibranchs and gastropods in coarse limy sandstone was recovered from the top of the formation; but nothing like the well-known brachiopod limestone of Shenley Hill was obtained, either from that level or from the base of the Chalk—the two horizons to which the Shenley Hill bed has been variously and vigorously assigned.

Gault.—In a well at Girton[7] the sandy base of the Gault yielded ammonites characteristic of the Lower Gault (Dentatus Zone), preserved in black phosphate. As a lithologically similar bed is recorded in many borings, Lower Gault is probably present over

[1] Information due to Messrs. Pick, Everard, Keay and Gimson.

[2] ' The Corallian Rocks of St. Ives (Hunts.) and Elsworth,' *Quart. Journ. Geol. Soc.*, vol. lvii, 1901, pp. 73-83.

[3] Wedd, C. B., *op. cit.*; Spath, L. F., ' Revision of the Jurassic Cephalopod Fauna of Kachh (Cutch),' part vi, *Palaeontologia Indica*, New Series, vol. ix, No. 2, 1933, pp. 866-7.

[4] Arkell, W. J., ' The Jurassic System in Great Britain,' 1933, pp. 412-3.

[5] ' The Jurassic System in Great Britain,' 1933, pp. 409, 412.

[6] Information due to Messrs. C. J. Ell & Sons, and Messrs. Laporte.

[7] Information from Messrs. G. W. Lack & Sons.

most of south-west Cambridgeshire, though no evidence of its thickness has been obtained.

Drift. —North of Great Barford Dr. Sherlock finds the ground west of the Ouse smothered with Boulder Clay, the Jurassic being exposed only in the deeper valleys. Below Roxton a wide spread of gravel borders the river, its boundary against the boulder-clay being unmarked, as a rule, by any feature; the gravel is dug around Wyboston and yields bones of mammoth, horse, etc. At Langford End, Tempsford, a north-and-south ridge of boulder-clay is interrupted by a wide embayment of gravel spreading eastward over the Oxford Clay. East of the L. & N.E. Railway and of Little Barford there is another spread of boulder-clay, the southern edge of which forms a prominent feature trending W.N.W. from Stone Hill Farm to Alington Hill, and then turning northward. A small moraine-like ridge crosses the railway one mile south of Little Barford.

Water Supply. —The search for water was active this year, and not only in the area of Jurassic clays, where supplies are naturally poor. Districts well endowed with underground water from the Chalk or Lower Greensand have suffered loss from the drought. Old wells have been condemned either owing to new contamination due to the outward spread of population, or because of the greater purity now demanded for village supplies. A number of villages will therefore have a piped supply from the prolific boring, in the Middle and Lower Chalk, put down by the South Cambridgeshire Rural District Council between Linton and Hildersham.

Though yields from its lower division have been locally disappointing, borings in the Chalk have generally been successful except along the crest of the escarpment.

The Lower Greensand is practically the sole source of local supplies where the Gault outcrop is bare. On low ground the water rises to the surface under pressure, so that much of it is running to waste, either as perennial ' fountains ' or else, unseen, from the many wells formerly sunk for washing coprolites, but now ploughed over and lost to sight. Where the Gault is thickly overspread with boulder-clay, as in the plateau west of Cambridge, the Greensand has rarely been tapped, owing to the cost of boring and the trouble of hand-pumping.

Far different are conditions in the Jurassic clay-lands of Huntingdonshire and northern Bedfordshire. The small village population, largely dependent on grazing, was supplied mainly by springs, streams, rain water and shallow wells, some sunk in occasional patches of gravel. Its later increase, due to ' ribbon-building ' along roads, poultry-farming, and industrialization, had already overtaxed these meagre and superficial resources, which virtually dried up during the drought. Attempts to obtain potable supplies from underground sources have generally failed. The Marlstone of the Middle Lias is everywhere unproductive, while

the Northampton Sands and Ironstone are generally cut out by overlap a short distance south-east of the Nene. Only small supplies are obtainable, locally, from the Great Oolite Limestone or the Kellaways Rock, and in the deep these are likely to be saline.

West Midlands District

Keuper Sandstone. —The outcrop of this formation makes a ridge of high ground between Hartlebury and Uphampton, with a steep scarp looking west towards the Severn and a long dip-slope falling east-south-east to the Doverdale Fault, which runs north-north-west and is the western limit of the Keuper Marl of the Droitwich syncline. There are many cliff and quarry sections along the steep eastern bank of the Severn valley. At its northern end massive soft red sandstones, thought to overlie the Keuper basement breccia,[1] are well seen west of Lincomb. Higher beds succeed to the south, striking obliquely to the river cliff, and consist of sandstones alternating with breccias, conglomerates and subordinate marl bands. The conglomerate phase tends to thicken southwards, in conformity with the fact that the Keuper Sandstone is considerably thicker here than in more northerly and north-easterly areas of the main Midland outcrop, and can hardly be less than 700 ft. The highest thick band of coarse rock lies some 500 or 600 ft. above the base of the formation ; it consists of conglomerates, pebbly grits, marl breccias and gritty sandstones, often with a limy matrix, and forms a hard ' catbrain,' well known to local well-sinkers as a belt extending northwards from Uphampton beyond Waresley.

Keuper Marl.—This group occurs in the Droitwich syncline; also in a southward-pitching syncline near Hadley, and south of Ombersley. In the lower part hard ' skerry ' bands are common, and sometimes form persistent features; one such band seems to have been quarried 1 mile south-east of Ombersley village. The marls have also been examined in a deep sewer tunnel in the city of Worcester.

Glacial and Recent.—No mappable boulder-clay occurs, but Bunter pebbles, often faceted or fretted by sand blast, are widely scattered over the Keuper outcrop. The age-relation of this wind action to the river terraces has not yet been determined.

Conspicuous terraces are found in the Severn valley at Holt and Grimley, respectively 60 to 65 and 25 to 30 ft. above the alluvium; and the same levels are recognizable east of the river. In the Salwarpe valley, opposite the entry of Hadley Brook, a pronounced shelf at 105 to 110 ft. O.D. has a mere skin of stony soil. Other shelves with pebbly or sandy veneer occur up to the 200-ft. contour in the Hadley and Elmley Brook valleys, and may correspond to the higher Salwarpe terraces mapped by Dr. George.[2]

C. H. Dinham.

[1] Hull, E., ' The Triassic and Permian Rocks of the Midland Counties of England ' (*Mem. Geol. Surv.*), 1869, p. 69.
[2] ' Summary of Progress for 1932 ' Part I (*Mem. Geol. Surv.*), 1933, p. 45.

EX BIBL. UNIV. EDINBURGEN

3. YORKSHIRE DISTRICT

HEADQUARTERS : YORK

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DURING 1934 the activities of the staff have been almost confined to indoor work, partly in connexion with Museum exhibits; considerable progress has been made in the publication of six-inch maps of areas recently surveyed. Mr. Edwards did a small amount of field work in cleaning up the area shown on the one-inch map Sheet 78 (Wakefield). He has paid special attention to the distribution of wind-faceted and polished pebbles in the drift, briefly alluded to last year.[1]

SKIPTON ANTICLINE

Dr. Mitchell alone has had a full season's field work. He has mapped a tract of country on the northern margin of the Bradford Sheet (69) together with a marginal overlap into the Pateley Bridge Sheet (61). The area surveyed extends from the northern suburbs of Skipton, eastwards to the southern part of Blubberhouses Moor on the north, while the southern limits are set by a line extending approximately from Cononley to Ilkley.

The structure is dominated by the Skipton Anticline, an important fold, extending from the northern part of the town of Skipton, in an east-north-easterly direction, to the neighbourhood of Bolton Abbey. Movement has been repeated along this line on several occasions. Thus the Carboniferous Limestone, while dipping steeply and steadily on the northern flank, is severely folded and buckled on the southern limb. The Bowland Shales and Millstone Grits, on the other hand, are comparatively gently folded and similar folds persist to the south in the Millstone Grits.

Carboniferous Limestone Series.—The oldest rocks occur in the core of the anticline and are known locally as the Skipton Rock. They consist of a series of black limestones with interbedded thin black shales, well exposed in the large quarries of Haw Bank. A prominent shale parting occurs at Skipton Castle and is followed by another limestone, which may be called the ' Skipton Castle Limestone,' and marks the summit of the main limestone mass. The thickness of this group approaches 1,000 feet.

A thick series of shales with limestones lies above the Skipton Castle Limestone and probably reaches a thickness of nearly 3,000 feet. It is marked by two important limestone horizons, the lower, some 1,500 feet from the base, known as the ' Embsay Limestone,' while the ' Eastley Limestone ' lies at the summit of the series.

[1] ' Summary of Progress ' for 1933, Part I (*Mem. Geol. Surv.*), 1934, p. 49.

Their respective thicknesses are about 450 feet and 150 feet. Both are readily traced along the northern flank of the Skipton Anticline and are well-developed near the villages whose names they bear.

On the southern flank of the anticline only the Eastley Limestone has so far been recognized, the Embsay Limestone being apparently faulted out.

Sandy shales with thin limestones are developed in places above the Eastley Limestone and are involved in the same folding as the beds below. An important unconformity occurs above these beds.

Bowland Shales and Millstone Grit.—The Bowland Shales lie above the unconformity and dip steadily on both sides of the anticline. Severe folding, such as affects the beds below, is nowhere to be seen. The lowest beds are sandy and flaggy shales with impure, usually crinoidal limestones. Upwards the shales are calcareous and black impure limestones are common. These lower beds yield goniatites and lamellibranchs of P_1 age. A well-marked sandstone lies above them and has been called the ' Pendleside Sandstone.' This bed thins out westwards before Draughton is reached, the succeeding black, often ferruginous, shales yielding goniatites of P_2 age, apparently resting with slight unconformity on the P_1 shales below. In their turn the P_2 shales are succeeded by limestones, often shaly but rich in fragments of small crinoids, which are best developed at Berwick East and thin both to the east and west of that farm. They are overlain by black shales of E_1 age, which in their turn rest unconformably on the beds below, and mark the summit of the Bowland Shales.

The Millstone Grits follow the Bowland Shales. The lowest beds consist of alternating coarse grits and shales with flaggy beds, all changing rapidly in thickness, and occupy Skipton Moor. An important series of flags succeeds the grits near Bradley and has been much quarried. These beds, the ' Bradley Flags,' contain, at High Bradley, a thin coal which has been worked at crop for a considerable distance. About 300 feet above the coal a marine band has been traced from Bradley to Edge. Goniatites show the age to be E_2.

Higher in the succession the marine band of Marchup has been followed from Middle Marchup eastwards to Addingham and Marsh Ghyll Reservoir near Moor Houses, Middleton; it is of E_2 age. Another marine band of late E_2 age has been found between Gildersber and Langbar. A still higher band, of H age, has been traced from Ling Park to Myddleton Lodge. This is overlain by shales forming an outlier north of the River Wharfe. Fossils of this age have also been collected from Lumb Beck east of Small Banks, on the southern side of the Wharfe valley.

In the Millstone Grit area north of Leeds Mr. Edwards has examined two water-bores which afford valuable evidence bearing on the age and structure of the rocks. That at Sicklinghall Water-

works, 3 miles west of Wetherby, penetrated 151 feet of red, brown, yellow and grey micaceous sandstones and flags and then cut marine shales to a depth of 175 feet from the surface. The goniatites identified by Mr. W. S. Bisat include *Reticuloceras davisi, R. inconstans, Homoceras sp.* resembling *H. striolatum,* and *Homoceratoides divaricatum,* etc., were also found. It appears that this is the marine band above the Cayton Gill Beds at the base of the R_1 zone, recorded by Dr. Hudson near Spofforth Haggs, two miles to the south-south-west.[1]

The other borehole, at Wetherby Waterworks, 1 mile west-south-west of Bardsey, proved a marine band at 170 to 200 feet, beneath massive grits and flaggy sandstones. The goniatites include several different variants of *Reticuloceras eoreticulatum,* with the *R. davisi* form. They appear to indicate an horizon somewhat higher than that at Sicklinghall Waterworks.

In the coalfield, three boreholes now being made near Swillington for Messrs. Pease and Partners are proving the great abundance of *Carbonicola* bands in the measures between the Flockton and Middleton Main horizons. A *Lingula* Band has also been found 130 feet above the Middleton Little Coal. If this band occurs over a sufficiently wide area it may prove to be an index horizon of great value.

C. E. N. Bromehead.

[1] Hudson, R. G. S., 'The Millstone Grit Succession south of Harrogate,' *Trans. Leeds Geol. Assoc.*, vol. v, Part 2, 1932-33, pp. 121, 124.

4. LANCASHIRE DISTRICT

HEADQUARTERS : MANCHESTER

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IN Lancashire work has proceeded on the production of the Wigan Memoir, Sheet 84, which on account of the extent of the mining operations in the district has proved a heavy task. The bulk of this work is being done by Mr. Jones. A limited amount of field work has also been done by Mr. Whitehead and Mr. Tonks in the Preston district and only a few square miles of Sheet 75 remain to be completed in the spring. Mr. Whitehead has otherwise been engaged on the production of memoirs on the Dudley and Shrewsbury areas. Mr. Tonks was transferred to the Scottish staff for three months and Mr. Jones for six weeks.

PRESTON DISTRICT

Triassic, Glacial and Recent.—The field work of the past season has dealt entirely with the plain of West Lancashire where drift deposits with little variety of surface feature mask the underlying Bunter Sandstone and Keuper Marl. The area is, however, of interest owing to the widespread occurrence, between upper and lower boulder-clays, of sheets of sand of such extent and continuity as to indicate retreat and readvance of the ice. These are the ' Middle Sands ' of E. Hull, concerning the interglacial significance of which there has been much discussion. As the only fossils associated with them are the derived marine shells common to all the drifts of West Lancashire a retreat of interglacial magnitude is hardly demanded for their formation, but they are most certainly interstadial and any evidence as to their relations to the several sheets of boulder-clay is thus of considerable importance.

In the area south of the Ribble, surveyed by Mr. Whitehead, the ' solid ' rocks appear in only two places. East of Mawdesley village the Bunter Sandstone is free from drift in an area of less than ten acres; while about a mile to the north-east the same formation is exposed in the road-side, under boulder-clay. The boulder-clay of this area is a stiff chocolate or bluish clay, weathering to purple or red, with many sand-grains, a few small shell-fragments and stones and boulders including granites of Scottish and Lake District type and Carboniferous limestone. It forms gently rolling ground which rises almost imperceptibly from the alluvial flats of the Douglas and Yarrow and their tributaries.

The Shirdley Hill Sand also forms faintly rising ground between Croston and Mawdesley and in this neighbourhood both the Shirdley Hill Sand and the boulder-clay are, in places, covered by peat. Peat also lies on the boulder-clay at a somewhat higher

level (about 75 ft. O.D.) east of Little Hoole. The peat weathers away rapidly after being broken up by tillage, and the area of peat *in situ* (as distinguished from merely peaty soil) is now considerably less than that shown on the Old Series geological map.

North of the Ribble sand and gravel occupy considerable areas near Kirkham. The uneven surface upon which the Upper Boulder-Clay rests suggests that the sand and gravel were subjected to denudation before the deposition of the overlying boulder-clay, the bottom part of which is very sandy. In addition to the main deposit there are small patches of sand and gravel that appear to be unconnected with it and are probably lenticles in the Upper Boulder-Clay.

The greater part of the area surveyed by Mr. Tonks east of Preston consists of boulder-clay plain with few surface features of importance. The Ribble and its attendant tributaries, however, trench deeply into the plain, and along the sides of these main and subsidiary valleys, this boulder-clay is seen to rest on sand. This relationship is observable in many places, but, owing to downwash and obscuring vegetation, clear exposures of the lower part of the valley sides are rare. A boulder-clay below the 'Middle' Sands, as they have long been called, is seen in places, but evidence has recently been obtained showing that an additional boulder-clay is sometimes present and splits the Middle Sands into two. Thus in a section half a mile west of Fishwick, below 20 ft. of reddish yellow boulder-clay, 25 ft. of sand overlies 20 ft. of dark purplish brown boulder-clay with sparse stones, which in turn rests on some 25 ft. of sand, and below the lower sand the lowermost boulder-clay is discernible further east. By feature this five-fold division can be traced for some three miles along the north side of the Ribble valley to Brockholes. In clay and sand pits south of Preston cemetery the junction of the middle boulder-clay with the upper sand presents interesting features. Thin beds of laminated clay overlying the middle boulder-clay are contorted, standing with laminae vertical, and thrust into the heart of masses of stony boulder-clay. Over these contorted clays lie horizontally bedded, fine-grained sands of the upper Middle Sands division with the uppermost boulder-clay above.

It is perhaps worth noting that this middle boulder-clay closely resembles, in appearance and character, the upper boulder-clay of the Manchester area, some part of which may have been deposited as a lake clay. The uppermost boulder-clay of the Preston district, however, is a true boulder-clay containing abundant erratics and attaining a thickness of some 40 to 50 ft.

In the south-western part of the area the boulder-clay plain of the Leyland-Mawdesley area ends seaward against wide spreads of low lying peat and recent marine alluvium. From a short distance south of Ruffold northwards to the Ribble the river Douglas flows in a valley cut into this plain, thus isolating and forming the detached boulder-clay area of Tarleton and Hesketh Bank. Farther west, islands of boulder-clay emerge from the peat, and patches of

Shirdley Hill Sand are associated with these boulder-clay areas where wind-faceted pebbles are also occasionally seen.

The most remarkable feature of this south-western area is the amount of accretion and enclosure of marshland that has occurred within the last 70 years. Some 4 or 5 square miles of estuarine saltings are now enclosed and cultivated behind flood embankments, and seawards of these embankments the saltings are extending rapidly towards the channel of the Ribble. The natural processes of accretion and silting up have been hastened by the fact that the Ribble no longer meanders within its estuary in a channel changing yearly, but is confined within training walls westwards from Preston for a distance of 15 miles.

Dr. W. B. Wright has continued to attend the meetings of the River Mersey Committee of the Water Pollution Research Board, so as to be available for consultation in case any question of geology should arise.

W. B. Wright.

5. CUMBRIAN DISTRICT AND FOREST OF DEAN

T. Eastwood, A.R.C.Sc., District Geologist.
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W. C. C. Rose, M.Sc. } Geologists.

IN the earlier part of the year the members of this unit were mainly occupied on Museum work and in the preparation of the maps and memoir of the Gosforth district. The one-inch map of that district is now ready for engraving, while the memoir has been completed in manuscript.

In the Forest of Dean profuse vegetation—particularly bracken—completely obscures many of the outcrops for several months in the year, but about half the coalfield has now been surveyed. Much mining information, however, remains to be collected.

Dr. Trotter was engaged on the Coal Measures of the eastern part of the Forest and adjoining tracts of other formations. Mr. Eastwood surveyed part of the ground near Monmouth, and Mr. Rose worked in the Wye valley about Whitchurch.

Silurian.—Dr. Trotter reports that two small inliers of Ludlow rocks occur at Aram, about half a mile south-west of Newnham Church, and evidently occupy the crest of a pre-Triassic anticline that trends southwards from May Hill through Tites Point at Purton east of the Severn. Old Red Sandstone and Keuper Marl flank the anticline to the west and east respectively.

The best exposure is in an old quarry 250 yds. south of Aram. Here, about 50 ft. of greenish-grey, sandy, micaceous flags and calcareous mudstones, with occasional limestone bands, appear to dip W. 10° S. at 60° to 85°, but are probably overturned, as are also the marls and sandstones of the adjacent ' Old Red Sandstone.'

These inliers do not appear on the Old Series one-inch Geological Map though Phillips[1] records beds with Silurian fossils from Aram.

Old Red Sandstone.—This formation, using this term to include all the red rocks between Carboniferous and Ludlow, appears to be at least 7,000 ft. in thickness. Argillaceous sediments prevail in the lower half, sandstones in the upper half, and give way to conglomerates and pebbly sandstones in the uppermost 400 ft. A band of limestone occurs about 1,000 ft. above the base of the sequence near Longhope, and others are present in the uppermost 1,000 ft. near Monmouth.

Dr. Trotter finds that the pre-Triassic anticline of May Hill and Tites Point may be traced within the Old Red Sandstone southwards from the Ludlow inliers of Newnham to the Severn, 1¼ miles south-east of Blakeney. Much of the eastern limb is concealed by

[1] Mem. Geol. Surv. of Great Britain, vol. ii, pt. 1, 1848, p. 190.

later sediments, but in the few exposures available the dip is generally east-north-east at angles from 20° to 50°. In the western limb there is a belt of highly inclined measures. This is followed by a belt of ground with dips from 20° to 50°, but high dips are resumed farther west.

Marl Group.—The actual junction with the Ludlow is not visible; the lowest beds exposed probably lie some 600 ft. up in the sequence. The upper boundary has been traced in a general northerly direction from half a mile west of Blakeney to half a mile east of Mitcheldean. The group consists of red marls with green streaks and patches associated with calcite veining, and frequently containing pencil- and stick-like calcareous nodules at right angles to the bedding. Some sandstones also are present, but are most frequent near the base and top of the group.

Arenaceous Group.—In this thick group of sandstones two belts of strata, several hundred feet in thickness, in which shale bands alternate with sandstone, occur near the middle of the group. In addition there is the Quartz Conglomerate.

West of the Wye in the Whitchurch area Mr. Rose reports a thickness of over 3,000 ft. of measures belonging to the arenaceous group. Apart from the Quartz Conglomerate, there are no distinctive beds. A section typical of this belt of strata may be seen near Goodrich Castle, and consists of dull red and purple sandstone, false-bedded in part, with thin and impersistent conglomerate cornstones and marls.

The Quartz Conglomerate, which is in two bands separated by pebbly sandstones and thin marls, has been traced from Goodrich almost to Monmouth. The best section is on the roadside north-west of Huntsham Hill, where the total thickness is about 100 ft.

West and south of Monmouth, about 1,000 ft. of the uppermost beds of the Old Red Sandstone are present. Although sandstones are common they are nowhere of great thickness, except in the upper part where they are associated with the Quartz Conglomerate. Argillaceous rocks—frequently calcareous—make up much of the strata. These contain at least two beds of limestone which reach or exceed 10 ft. in thickness.

Owing partly to the slope of the ground and partly to rolling of the strata the Quartz Conglomerate covers much of the region about Pennalt and Trellick Hill. In the latter locality it is quarried for sand and gravel; elsewhere it has been worked for building stone and for the circular stones used in cider presses. Two outliers separated by a fault occur west of the main outcrop and cap the hill known as Craig-y-dorth.

Lower Carboniferous. —The Lower Carboniferous, comprised of the Lower Limestone Shales, Lower Dolomite, Crease Limestone, Whitehead Limestone, and Drybrook Sandstone, is present on both sides of the coalfield though near Danby Lodge, in the south-east, the Trenchard Measures, at the base of the Coal Measures, transgress on to the Quartz Conglomerate of the Old Red Sandstone.

On the east side of the Forest of Dean haematite has been mined, chiefly from the Crease Limestone, though the outcrop of a band, reported to be not more than 3 ft. thick, may be followed within the Drybrook Sandstone.

The Lower Limestone Shales, some 220 to 240 ft. in thickness, are well exposed in quarries on the western side of Great Doward and include several bands of gritty and oolitic limestone.

The Lower Dolomite, about 240 ft. thick, is a compact grey or dull-brown dolomite of uniform character, admirably exposed in the cliffs along the Wye valley. Quarries between King Arthur's Cave and Great Doward show about 15 ft. of crinoidal limestone at the base, while the remaining 45 or 50 ft. is made up of white oolite which elsewhere is replaced by coarse dolomite.

The Whitehead Limestone, which is just over 100 ft. in thickness, consists of white-weathering, porcellanous limestones, somewhat nodular, with irregular beds of greenish clay. Algal limestones similar to those of Mitcheldean occur on Great Doward.

There are no good sections of the Drybrook Sandstone, but it appears to consist of soft, brownish sandstones with scattered pebbles of quartz. Near Symonds Yat 250 ft. of the formation emerges beneath the transgressive Coal Measures; farther to the north-east the overstep is complete.

Coal Measures. —The Coleford High Delf is the principal seam of the Forest and has recently been reached at a depth of 694 ft. at the new shaft of the Northern United Colliery, between Nailbridge and Brierley. The sinking was examined by Dr. Trotter and Mr. A. Templeman, but proved somewhat disappointing as most of the measures are barren of fossils.

In the Danby Lodge area, the massive Pennant Sandstone, some 600-700 ft. thick, that lies between the Coleford High Delf and the overlying Brazily seams, is divided by the Whittington and Yorkley coals. Outcrop workings of the last named have been traced northwards as far as Ruspidge Halt.

The lowest 250 ft. of the succeeding Household Coal Measures are dominantly shaly and contain five coals that have been mined considerably. There is some variation in the characters of these seams. The Churchway High Delf, for instance, splits into two, if not three, seams south of Cinderford, and the Lowery Seam is double to the west of a line between Parkend and Nailbridge.

None of the seams in the next 700 ft. of strata has been worked extensively. In the north these measures are essentially arenaceous and are represented near Drybrook Road Station by thick, massive, Pennant-like sandstone, but to the south several bands of the shale make this appearance. The mapping of these measures and the succeeding Worgreen coals is now almost completed.

T. EASTWOOD.

6. NORTHUMBERLAND AND DURHAM DISTRICT

R. G. Carruthers, District Geologist.
G. A. Burnett, B.Sc. } Senior Geologists.
A. Fowler, M.A., B.Sc. }
W. Anderson, M.Sc., Geologist.

THE revision of Sheet 8 (Elsdon) south of the Cheviot massif, was completed in the 1934 field-season. Starting later than usual, owing to work in connexion with the Rothbury memoir, Mr. Fowler joined Mr. Anderson in the country between the Rede and North Tyne valleys, and subsequently both moved westwards into Sheet 7, Mr. Anderson to the moorlands up to the Border at Peel Fell, Mr. Fowler to the North Tyne valley. Mr. Burnett was at work nearer Newcastle, in Sheet 14, where much ground was revised in the southern part of the map, amongst the Middle and Upper Limestone Groups. Mining information was also obtained for the completion of various six-inch maps in the Coal Measure areas to the east.

Cementstone Group.—Mr. Anderson reports that amongst the 400 ft. of Cementstone strata seen up the valley of the Kielder Burn, limestones are numerous towards the top, and the uppermost one, 15 ft. thick south-east of Rigend, is crowded with algal pellets; on the Border, in the rises of the Scalp Burn, it has dwindled to 4 ft., and algae are rare. Five limestones are seen below this horizon around Rigend, the middle one crinoidal. Lower down the valley, Mr. Fowler noted a few crinoid ossicles in a 15-ft. limestone, surmounted by shales with *Producti* and *Pecten*-like shells, and somewhat similar strata recur in the Kielder Burn half-a-mile upstream from the Castle. All these beds must lie towards the top of the Group, but exact correlations cannot yet be made.

Fell Sandstone.—Near the Border, at the head of the Kielder valley, this Group is not far short of 600 ft. thick; a 40-ft. bed of soft purplish marls and clay-shales near the base has given rise to many great landslips. Lower down the west side of the valley, towards the North Tyne, a straw-coloured sandstone makes a strong escarpment, culminating in Grey's Pike (1,461 ft.), where the rock is unusual for its brick-red weathering.

Scremerston Coal Group.—The well-known Carter Coal, lying at the base of this Group, has been wrought along the Carry Burn and in the Bateinghope valley; at the former locality the seam has a 2-ft. blue crinoidal limestone a few feet above, as it had in sinkings on the Scottish side of the Border. About 100 ft. higher up a rubbly limestone with large *Producti* and ' horn corals ' was noted, quite 8 ft. thick.

On the southern flanks of the North Tyne valley thoroughly marine strata (a 9-in. limestone with underlying shales) recur, with *Producti*, rhynchonellids, bryozoa and *Lithostrotion*. There is

an excellent section along the stream south-west of Mounces, but higher strata hereabouts are of the more usual estuarine type, with entomostraca and small gastropods. There are other good sections along Hunter's Burn, in the remote Burngrange Moor country towards the western edge of Sheet 8. Some 60 ft. of shale and sandstones are seen, with thin coals near the base, and limestones with excellent casts of *Producti* and other brachiopods; further marine horizons are known hereabouts at a somewhat higher level.

The relative position of these beds in the sequence is not yet known, but they are undoubtedly below the Redesdale Limestone and therefore in the lower half of the Group.

All the evidence in Sheets 7 and 8 shows that the Group as a whole is far more marine than in the type areas east and north-east of the Cheviots; that this is so in the upper half, above the Redesdale Limestone, has long been known, but now we find that the lower measures are similarly affected.

Along the southern margin of Sheet 8 the Redesdale and Fourlaws Limestones are seen in quarries on Corsenside Common, and the Fourlaws Coal, after a century of mining, is still being wrought around Hareshaw Head. Recent information has led to considerable revision of the maps hereabouts. An average section of the seam here is top coal 6 in., band 5 in., coal 2 ft., but the band at times thickens out to 18 in. Further north, on Blakehope Fell, two miles west of Otterburn, the coal is only 2 ft. thick.

Limestone Group.—Little work was done in this Group in Sheet 8, though Mr. Anderson reports a discovery of the Oxford Limestone 18 ft. thick and full of ' Girvanella ' nodules, in the Tofts Burn, three miles west of south from Otterburn. On the other hand Mr. Burnett's field-work, in Sheet 14, lay entirely in these strata. The Middle Limestones outcrop west and south-west of Ryal, the Eight-Yard with its characteristic *Saccammina* band 18 in. thick and 4 ft. 6 in. from the top.

In the Upper Group one of the more curious points noted is that the Ingoe Grits, well known from their exposure immediately above the Little Limestone at Ingoe Crags, are not grits but normal massive sandstones. Possibly Professor Lebour, the originator of the term as a stratigraphical horizon, confused the name with ' Uggoe,' a hill 800 yds. to the south, where a grit quite 30 ft. thick outcrops below, not above, the Little Limestone.

Some revision will be necessary in the outcrops of the Upper Limestones around Stamfordham. A water-boring in 1933 definitely proved that the thick limestone at Mainsbank was the Corbridge, and not, as hitherto thought, the first below that position. Amongst higher strata, the Harlow Hill Limestone has been followed from the type locality northwards past Cheeseburn Grange, always with masses of *Lithostrotion* and many *Producti* in its upper part; it is covered by a 50-ft. sandstone, somewhat coarse and gritty near the base.

Glacial.—Over the areas revised in Sheets 7 and 8, boulder-clay of normal type is the rule, and for that matter in Sheet 14 also, where over 120 ft. of it was got in a bore at Dissington East Houses. Around Bingfield, however, sands and gravel appear, and occasional ' kettle-holes ' indicate a considerable amount of dirt-laden ' dead ice ' hereabouts at the close of glaciation.

R. G. CARRUTHERS.

(B)—SCOTLAND

1. CENTRAL COALFIELD AND FIFE

T. Robertson, B.Sc., Ph.D., A.Inst.M.M. } Senior
D. Haldane, B.Sc. } Geologists.

J. K. Allan, M.A., B.Sc. } Geologists.
J. Knox, B.Sc. }

THE economic memoir on Area I [Kilsyth] of the Central Coalfield is now nearing completion. In connexion with its preparation Dr. Robertson and Mr. Haldane have examined numerous underground sections and surface exposures in the Kilsyth and Kirkintilloch district. Special attention has been given to the numerous older and more recent sand-quarries which are exploiting the fluvio-glacial sands and gravels of the Kelvin valley.

The replacement, by the Ordnance Survey, of the six-inch maps of Stirlingshire by a new series based on the meridian used for Lanarkshire has afforded occasion for adding further information to the new issues of the geological maps of the Falkirk, Larbert and Plean area. Dr. Robertson has already completed four sheets in the Falkirk area, and he and Mr. Allan will, in the near future, have ready for publication the four sheets that include Denny, Plean and Airth.

A new edition of six-inch sheet Lanark 6 N.E. has been prepared by Mr. Allan and is now in the press.

Messrs. Allan and Knox have, during the year, kept in close touch with the mining companies in Fife and have examined numerous underground sections and borings in the Carboniferous Limestone Series. They are now preparing for publication the third of the series of Economic Memoirs describing the coalfields of the county of Fife.

M. Macgregor.

2. WEST HIGHLAND DISTRICT

J. E. Richey, M.C., Sc.D., District Geologist.
J. B. Simpson, D.Sc. } Senior Geologists.
L. H. Tonks, M.Sc. }
R. C. B. Jones, M.C., M.Sc., Geologist.

DURING the summer field work was completed in Sheet 52 (Sunart) and was extended northwards into Sheet 61 (Mallaig) by the above-named geologists, Mr. Tonks and Mr. Jones being lent from the Manchester unit. Mr. A. G. MacGregor and Dr. Kennedy were engaged continuously on Museum work, with which Dr. Richey was also largely occupied.

Dr. Simpson surveyed the country from Glen Aladale northwards towards Loch Eilt, and part of the Ardnish peninsula west of Lochailort. Mr. Tonks was engaged farther west between the head of Glen Moidart and Lochailort, and also assisted Mr. Jones, who continued his work in the Strontian district during July and part of August.

Moine Schists. —Several alternating belts of psammitic and pelitic schists were traced northwards into Sheet 61. Everywhere the schists carry abundant pegmatitic injection, which occurs mainly in concordant veins in the psammitic schists and forms injection-gneisses with the pelitic schists.

In the western part of Sheet 52 the strike of the schists is north, in the north-eastern part it is as a rule north-east. Between these areas of different strike there is a zone of complicated folding that extends from a point on Loch Sunart 3½ miles west of Strontian northwards through Ben Resipol and Beinn Gàire, respectively south and north of Loch Shiel, into Sheet 61. The main structural elements of this complex zone are as follows.

At the southern end of the zone of folding between Loch Sunart and the summit of Ben Resipol there is a synclinal structure with a southerly pitch, traversed by north-east faults which are parallel to the adjoining margin of the Caledonian granite-complex of Strontian and Morvern. Owing to a lateral passage of pelitic schists into a mixed pelitic and psammitic assemblage, mapping is often difficult, but a thin band of quartzite traceable over a large part of this area elucidates the structure.

North of Ben Resipol the zone of folding is continued in a narrow elongate synclinal fold extending in a south-north direction between Ben Resipol and Cruach a' Ghaill north of Loch Shiel, and still farther north in a broad synclinal fold on Beinn Gàire. In Sheet 61 a continuation of the zone is shown in an abrupt change of strike from a north-east direction on the eastern side of Glen Aladale to north-west on the western side. A useful index-horizon in this district is provided by a belt of garnetiferous pelitic schist with occasional crystals of tourmaline. It forms the

north-westwardly running ridge of Druim Fiaclach to the west, extends southwards down Glen Aladale, and then turns back to traverse Beinn Mhic Cèdidh in a north-easterly direction. It is noteworthy that an identical tourmaline-bearing pelitic belt is also found on the eastern side of the zone of folding south-east of Loch Shiel from Gorstanvorran south-westwards to Polloch.

West of the zone of folding the northern strike prevalent in Sheet 52 changes direction to north-north-east and north-east in Sheet 61 between the upper part of Glen Moidart and Kinlochailort. There, a number of alternating belts of psammitic and pelitic schists have been traced in continuation of belts previously mapped in Sheet 52.

Some of the concordant pegmatites traversing psammitic schists are thick veins. A notable example, 50 feet in width, runs southwards from near Inverailort for several hundred yards. The pegmatitic injection in the pelitic schists is particularly profuse over an area a square mile in extent just west of Lochan nan Sleubhaich, 2½ miles east-south-east of the head of Loch Eilt.

Minor Intrusions.—In contrast to their abundance in Sheet 52, dykes and sills are scarce in the portion of Sheet 61 so far mapped. Sills of the appinite suite, so abundant on Beinn Gàire, are sparse or absent farther north. A broad porphyrite dyke of Lower Old Red Sandstone type, running west and east, has been traced discontinuously from the western coast of the Ardnish peninsula, near Loch an Fhearainn Duibh, eastwards past Eilean Dubh on Loch Ailort across the northern shoulders of Beinn Coire nan Gall, Diollaid Mhòr, and Beinn Odhar Mhòr, almost to the eastern margin of Sheet 61, a distance of 10½ miles. Tertiary basic dykes are fairly common in the Ardnish peninsula and in general trend north-north-westwards.

J. E. Richey.

3. SHETLAND

G. V. Wilson, B.Sc., District Geologist.
T. Robertson, B.Sc., Ph.D., A.Inst.M.M., Senior Geologist.
J. K. Allan, M.A., B.Sc.
S. Buchan, Ph.D., B.Sc. } Geologists.

THE geological mapping of the Shetland Islands was completed during the past field season. Messrs. Wilson, Robertson and Buchan were mainly engaged in the Walls peninsula and Mr. Allan in the ground around Hillswick and Esha Ness. The districts examined consist mainly of sediments and volcanic rocks of Middle Old Red Sandstone age, but small areas of older metamorphic rocks also occur.

Metamorphic Rocks.—The belt of metamorphic rocks which forms the northern coast of the Walls peninsula from Sandness to beyond Vementry consists of highly injected schists and gneisses, which in the ground to the west of Brindister Voe can be divided into a lower siliceous and felspathic group, and a higher group consisting largely of garnetiferous hornblende-schists. Subordinate thin bands of limestone also occur and are more prevalent in the higher group. In Vementry the rocks are intruded by a granitic mass which probably lies at no great depth in the ground to the south of its outcrop. West of Brindister Voe the dip of the foliation is to the south-east, but further west, in the vicinity of West Burra Firth, it takes on a south-westerly direction.

The metamorphic rocks of the Hillswick district have a general north-westerly strike and dip to the south-west at high angles. They are well exposed in the cliffs at Ura Firth and Sand Wick where they are sharply folded along axes roughly parallel to the strike. The pitch of the folds is very variable, and the width of the outcrop of any individual member of the series differs from place to place, as for instance on the two sides of Hillswick Ness. The rock-groups met with from south to north are :—

(8) Chlorite-hornblende-schist with epidote
(7) Silvery mica-schist and siliceous granulite
(6) Hornblende gneiss and granulite, rich in epidote.
(5) Muscovite-schist with garnet, kyanite and chloritoid
(4) Hornblendic gneiss and granulite
(3) Siliceous granulite
(2) Striped garnetiferous hornblende-schist
(1) Dark siliceous schist with pyrites

The hornblendic gneisses contain occasional sheared lenticles of serpentine or talc which are surrounded by zones that exhibit the following outward succession : anthophyllite-rock, actinolite schist, chlorite-schist and an outer layer of bronze-coloured biotite. In some instances, however, some of these zones may be either incomplete or missing.

Middle Old Red Sandstone.—In the Walls peninsula the unconformable base to the rocks of this age has now been traced from Sandness to the Stead of Aithness. At many localities along the line small patches of basal breccia, consisting largely of schist fragments, have been noted. These often rest on the underlying metamorphic rocks, though in some instances intervening fine-grained sandy bands occur. Very often, however, the junction is almost vertical and the relations between the two formations are obscured by small lines of shear, as for instance in the coastal sections near Snarra Ness. Further east, between Longa Water and Brindister Voe, the boundary is practically a straight line and appears to be a fault. The basal beds are succeeded southwards by a series of sediments and contemporaneous igneous rocks, about 5,000 ft. in thickness, with a general southerly dip. The sediments below the volcanic zone consist largely of gritty, grey or pinkish felspathic sandstones and quartzose rocks, with occasional thin flaggy bands and lenticular beds of breccia and conglomerate; in the vicinity of Clousta one of these beds of conglomerate locally attains a thickness of about 280 ft. A few wind-faceted pebbles (dreikanter) have been obtained by Dr. Robertson from the basal beds in this part of the area. South of a line extending from Whal Geo on the west coast to the Point of Sletta on Aith Voe, the direction of dip is very variable and a good deal of faulting and folding along north-north-east axes has taken place; consequently, it has not been found possible to establish any sequence in the main mass of the Walls Sandstones. In regard to the age of these beds there is little doubt that the lower members are older than the fish-bearing strata near Melby[1] which are considered to be of the same age as the Stromness Beds of Orkney. So far only a few indeterminate fish fragments and plant remains have been obtained from them; they may, perhaps, in part represent the Wick Flagstone Group and the so-called Barren Group of Caithness.[2]

Contemporaneous Igneous Rocks.—Volcanic rocks of Old Red Sandstone age outcrop at three separate localities in the area, and may be divided into the Clousta, Papa Stour and Esha Ness groups.

The Clousta group occurs about 3,000 ft. above the base of the Walls Sandstone and has a thickness of approximately 2,000 ft. It consists of a very variable series of acidic and basic lava flows with associated beds of ash and ashy sandstones. The group has been traced for a distance of more than seven miles, the best exposures occurring in the ground between Sulma Water and Clousta.

The igneous rocks of Papa Stour were examined by Messrs. Robertson and Buchan who find that they rest on a series of red and purple sandstones similar to those which contain a volcanic

[1] 'Summary of Progress for 1933,' Part I (*Mem. Geol. Surv.*), 1934, p. 76.
[2] 'The Geology of Caithness,' (*Mem. Geol. Surv.*), 1914, p. 3.

horizon on the Mainland at Melby. The lowest members consist of a series of highly decomposed basic lava flows with thin layers of interbedded soft purple sandstone. They are succeeded by a group of tuffs and sandstones which in the western portion of the island consist almost entirely of materials of volcanic origin. The succeeding rhyolites were formerly regarded as intrusions[1] but recently Dr. T. M. Finlay[2] came to the conclusion that they were lava flows. Careful examination of the ground has confirmed the latter view. It has been found, moreover, that two rhyolite flows occur separated by a bed of tuff and agglomerate which attains a maximum thickness of about 40 ft. The lower flow contains conspicuous spherulitic and porphyritic bands and is from 80 to 100 ft. in thickness. The upper one, whose top is not seen, must be over 200 ft. thick.

The Old Red Sandstone rocks of the Esha Ness district consist mainly of an interbedded series of lavas and ashes, and occupy the ground to the west of a line drawn from Brae Wick to Bratta Breck. They are disposed in a shallow syncline which is crossed by a large fault trending north-westwards through the head of Hamna Voe. North of this line of movement the fold pitches northwards while to the south the pitch is southwards.

A traverse of the coast-section between Stenness and Brae Wick, where the rocks are fully exposed, shows the following succession :—

Lava of The Minn
Upper Ash
Lavas of Stenness
Lower Ash
Lavas of Tangwick
Sandstones and grits

The lowest members of the sequence are exposed on the beach at Brae Wick and consist of a few feet of reddish-purple micaceous sandstones with associated ashy grits. The lavas as a whole are highly decomposed and most of them appear to be andesitic, though a prominent flow in the Tangwick group is a rhyolite with well-marked flow structure. The bands of ash are coarse in texture, and fairly well bedded, and contain abundant blocks of andesite together with occasional fragments of sandstone and schist.

In regard to the age of this group of volcanic rocks it appears most probable that they are contemporaneous with those at Papa Stour and Melby, which lie a short distance above the Melby fish-bed. In this connexion it is interesting to point out that thin bands of ashy material are occasionally met with in the Upper Stromness Beds of Hoy in Orkney.

G. V. Wilson.

[1] Geikie, A., 'On the Old Red Sandstone of Western Europe,' *Trans. Roy. Soc. Edin.*, Vol. xxviii, Pt. ii, 1878, p. 420; also Peach, B. N., and J. Horne, 'The Old Red Sandstone Volcanic Rocks of Scotland,' *Trans. Roy. Soc. Edin.*, Vol. xxxii, Pt. ii, 1884, p. 371.

[2] Finlay, T. M., 'The Old Red Sandstone of Shetland, Pt. ii, North-western Area,' *Trans. Roy. Soc. Edin.*, Vol. lvi, Pt. iii, p. 678.

4. SKYE

G. V. Wilson, B.Sc., District Geologist.
D. Haldane, B.Sc., Senior Geologist.
J. Knox, B.Sc., Geologist.

THE primary geological survey of Skye was resumed last summer by Messrs. Haldane and Knox, who were stationed in the northern part of the Trotternish peninsula. The area examined consists of a lower marginal platform of Jurassic sediments with numerous basic sills, and an upper plateau of Tertiary basaltic lavas.

Jurassic Sediments.—The area occupied by these rocks has been found to be much greater than was previously supposed. Together with the associated sills they occupy the whole of the eastern side of the peninsula as far inland as the base of the great basaltic escarpment which runs past the Old Man of Storr to beyond the Quirang. They also continue into the low ground on the western side as far south as Skudiburgh and reappear from beneath the lavas at Uig Bay and as an inlier in the valley of the river Conon behind Uig.

The beds consist of sandstones, limestones and shales, and have long been known to contain rocks of Upper Estuarine and Oxford Clay age. Recent work by Dr. Malcolm Macgregor[1] has demonstrated that beds as high in the sequence as the base of the Kimmeridge Clay are also present.

Tertiary Lavas.—Owing to the great accumulation of landslip material and talus scree the unconformable boundary between these rocks and the underlying sediments is nowhere exposed. It has, however, been possible to draw a fairly accurate line a short distance away from the base of the lava escarpment. The rocks have a westerly dip and form the central ridge of the peninsula, where a line of precipitous cliffs marks the eastern boundary of the lava outcrop. The various sections exhibit a succession of lava flows which are characterised by highly decomposed and slaggy tops and bottoms, and hard, black central portions. Occasional thin interbedded layers of red bole, shale and coaly matter also occur, but as yet no intrusive sills have been noted within the lava sequence.

Intrusive Igneous Rocks.—The sills traversing the Jurassic sediments are markedly transgressive and often cause a considerable amount of displacement of the strata. Their behaviour is well displayed in the excellent coastal sections in the vicinity of the Kilt Rock. They are often beautifully columnar and occupy the greater part of the area of the Jurassic outcrop. In composition they are found to be olivine-basalts similar to those occurring in the lava suite.

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[1] Macgregor, Malcolm, 'The Sedimentary Rocks of North Trotternish, Isle of Skye, *Proc. Geol. Assoc.*, vol. xlv, pt. 4, 1934, p. 400.

A great number of dykes of olivine-dolerite are found traversing the area. They have north-north-westerly trends, rarely exceed 15 ft. in thickness and often contain small porphyritic crystals of felspar. An interesting example exposed on the coast 475 ft. south of the waterfall at Elishader is exceedingly rich in olivine.

Superficial Deposits.—A remarkable feature of the district is the extent of landslipping that has taken place since the close of the Glacial Period. This phenomenon is best developed along the foot of the great lava escarpment, where it forms a belt from a quarter of a mile to a mile and a half in width. Smaller occurrences are also met with near Skudiburgh and in the vicinity of Uig. It has given rise to a striking type of topography consisting of pinnacles, hillocks and large rugged masses of basalt which have fallen away from the face of the lava scarp. These are separated by hollows and valleys which are often quite dry; others, however, contain small lochs which in many cases have no visible outlet, though the water is never stagnant. It is evident, therefore, that an underground drainage system exists within the landslip area, a fact that is borne out by the number of large springs that issue from the outer margin of the deposit. In all cases the slipped material consists of basalt derived from the adjoining crags, and it is only in a few instances that the underlying soft Jurassic clays are seen. The dip in the individual slipped masses varies considerably, and it is often tilted at high angles, while some of the masses have practically disintegrated into heaps of coarse angular rubble.

In considering the origin of these landslips there can be no doubt that they are due to the fact that an elevated mass of well-jointed rocks rests on a gently sloping surface of soft, slippery, impervious clay. In many respects they are comparable with that at Axmouth[1] and the one on Ben Evenagh in the north of Ireland[2], to mention two other well-known British examples.

G. V. Wilson.

[1] Lyell, C., 'Principles of Geology,' vol. i, 1867, p. 536.
[2] Portlock, J. C., 'Report on the Geology of County Londonderry, etc.,' 1843, p. 103.

III. SECTIONAL REPORTS

1. PALAEONTOLOGICAL DEPARTMENT

In London

J. PRINGLE, D.Sc., Palaeontologist (District Geologist).
C. P. CHATWIN, M.Sc., Assistant-Palaeontologist.
(Senior Geologist).
C. J. STUBBLEFIELD, Ph.D., A.R.C.Sc. (Geologist).

In Edinburgh

J. PRINGLE, D.Sc., Palaeontologist (District Geologist).

A. ENGLAND AND WALES

THERE is little to add to the outline of the general work done in this Department given in the Report of the Director (p. 32). Practically all the activities of the staff were devoted to the removal of the collections from Jermyn Street, their re-arrangement in new cabinets and the selection and preparation of specimens for the regional exhibits in the new Museum.

In connexion with the naming of fossils from the Dudley Sheet, however, Dr. Stubblefield has examined certain of the *Spirorbis* limestones which occur in the Halesowen Group of the Coal Measures, and he reports that *Anthraconauta calcifera* (Hind) occurs in association with three species of *Carbonia* in the Deuxhill outlier of Borle Brook and that a similar assemblage is also found in the Linley outlier to the north.

In rock-samples collected from a percussion boring near Watford, Dr. Stubblefield has obtained fossils which from their nature and associated lithology appear to be akin to the Downtonian or Lower Devonian strata encountered at Little Missenden.

During the summer Mr. W. Dewar visited a number of well sinkings and borings which were being made in Cambridgeshire and Huntingdonshire. At several of these, interesting details were obtained concerning the Corallian rocks. Thus, to the north-west of the Pike and Eel Inn, Over Ferry, compact fossiliferous Corallian Limestone was found to underlie the Elsworth Rock.

In a boring 200 yds. north-west of Hinwick House, Podington, a clay previously regarded as belonging to the Great Oolite Series has proved to be of Upper Lias age.

The following specimens in the Museum have been figured in publications :—

IN THE PALAEONTOGRAPHICAL SOCIETY'S VOLUME FOR THE YEAR 1932.
(Published 1934).

A Monograph of the British Cambrian Trilobites. (Part viii).

By MR. P. LAKE, M.A., F.G.S.

Centropleura henrici (*Salter*), pl. xxiv, figs. 3-5, 8, 10-12, p. 189 (7 specimens).
Paradoxides hicksi *Salter*, pl. xxv, figs. 4-6, 8, 9, p. 196 (5 specimens).

A Monograph of British Dendroid Graptolites. (Part iii).

By Dr. O. M. B. Bulman, D.I.C., A.R.C.Sc., F.G.S.

Dictyonema sp. *F.*, pl. vi, fig. 1, p. 65.
Callograptus hopkinsoni *Bulman*, pl. viii, fig. 5, p. 84.
,, radiatus *Hopkinson*, emend. pl. viii, fig. 7, p. 86.
,, salteri *Hall*, pl. ix, figs. 3-5, 7, p. 81; text-figs. 40a, c, p. 83 (12 specimens).
,, tenuis *Bulman*, pl. x, figs. 6-8, p. 90; text-figs. 43a-c, p. 91 (3 specimens).
,, ? circularis *Bulman*, pl. x, fig. 10, p. 91 (3 specimens).
Aspidograptus implicatus (*Hopkinson*), pl. ix, fig. 10, p. 71; text-fig. 36, p. 72 (13 specimens).

A Monograph of the Ammonoidea of the Gault. (Part xi).

By Dr. L. F. Spath, F.G.S.

Prohysteroceras (Neoharpoceras) hugardianum (*d'Orbigny*), pl. xlix, fig. 1c, p. 462.
Prohysteroceras (Neoharpoceras) irregulare *Spath*, pl. xlix, fig. 2, p. 463.
Prohysteroceras (Goodhallites) sp. ind., pl. lvi, fig. 10, p. 456.
Hysteroceras pseudocornutum *Spath*, pl. li, figs. 4a, b; pl. lv, figs. 4a, b, p. 491 (2 specimens).

A Monograph of British Corallian Lamellibranchia. (Part vi).

By Dr. W. J. Arkell, M.A., F.G.S.

Astarte ovata *Smith*, text-fig. 55, p. 234.

In the Palaeontographical Society's Volume for the Year 1933.

(Published 1934).

A Monograph of British Corallian Lamellibranchia. (Part vii).

By Dr. W. J. Arkell, M.A., F.G.S.

Eocallista tancrediformis (*Blake and Hudleston*), pl. xli, figs. 5, 5a, 9, p. 302.
Quenstedtia rodborensis (*Lycett*), text-figs. 69, 70 (in part), p. 296.
Pleuromya sp., text-fig. 72, p. 321.

A Monograph on the British Pleistocene Mammalia. Alces. (Supplement).

By Professor S. H. Reynolds, M.A., Sc.D., F.G.S.

Alces machlis *Ogilby*, text-fig. 2D, p. 5.

A Monograph of the British Palaeozoic Asterozoa. (Part ix).

By Dr. W. K. Spencer, M.A., F.R.S., F.G.S.

Bohemura granifer (*Whidborne*), pl. xxx, figs. 5, 6, p. 479; text-figs. 311, 312A, B, 313, pp. 480, 481.
Protaster salteri [*Forbes MS.*] *Salter*, pl. xxxi, fig. 5, p. 464; text-fig. 295, p. 454.
Protaster sedgwicki *Forbes*, pl. xxxii, fig. 5, p. 457; text-fig. 299A, p. 462.
Drepanaster scabrosus (*Whidborne*), pl. xxxii, fig. 6; text-fig. 291D, p. 449.

In the Quarterly Journal of the Geological Society, Volume XC.

New forms from the Insect Fauna of the British Coal Measures.

By Dr. H. Bolton, F.R.S.E., F.G.S.

Rectineura lineata *Bolton*, pl. ix, fig. 2; text-fig. 3, p. 281.
Gerarus ? symmetricus *Bolton*, pl. ix, fig. 4; text-fig. 4, p. 283.
Glaphyrophlebia delicatula *Bolton*, pl. ix, fig. 5; text-fig. 5, p. 284.
Polyetes problematica *Bolton*, pl. ix, fig. 6; text-fig. 6, p. 286.
Archaeotiphe regularis *Bolton*, pl. ix, fig. 7; text-fig. 7, p. 287.
Mesitoblatta nodulata *Bolton*, pl. x, fig. 8; text-fig. 8, p. 290.
Hapaloptera obovata *Bolton*, pl. x, fig. 11; text-fig. 11, p. 296.

Downtonian fossils from the Anglo-Welsh Area.

By Dr. F. R. Cowper Reed, M.A., F.G.S.

Ledopsis barroisi *F. R. C. Reed*, pl. xx, figs. 9, 10, p. 580 (3 specimens).

In the Annals and Magazine of Natural History, Volume XIV, Tenth Series

Airtonia, *a new Brachiopod Genus from the Lower Carboniferous of Yorkshire, with Notes on replacement of Shell Substance by Quartz.*

By Mr. F. Wolverson Cope, M.Sc., F.G.S.

Airtonia hudsoni *Cope*, text-figs. 6-8, p. 282 (3 specimens).

On the Genus Corbicella *and* Quenstedtia *Morris and Lycett: a Test Case in Nomenclature.*

By Dr. W. J. Arkell, M.A., F.G.S.

Corbicella complanata *Lycett*, pl. ix, figs. 1, 2 (4 views), p. 377.
Quenstedtia rodborensis (*Lycett*), pl. x, figs. 2, 2a, 3, 3a, 4, 4a, 5, p. 378 (4 specimens).

A Revision of the Trilobite Genera Deiphon *and* Onycopyge.

By Dr. W. F. Whittard, D.I.C., A.R.C.Sc., F.G.S.

Deiphon forbesi *Barrande, cf. var.* dikella *Whittard;* pl. xvi, figs. 5, 6, p. 517.

IN THE PHILOSOPHICAL TRANSACTIONS OF THE ROYAL SOCIETY OF LONDON, VOLUME CCXXIII, SERIES B.

VIII. *The Cambrian Area of Rushton (Shropshire).*

By DR. E. S. COBBOLD, F.G.S., AND DR. R. W. POCOCK, F.G.S.

Rushtonia lata *Cobbold*, pl. xl, figs. 1a-c, p. 324.
Torellella inornata *Cobbold*, pl. xl, fig. 2, p. 322.
,, scabra *Cobbold*, pl. xl, fig. 3, p. 323 (4 specimens).
Hyolithellus ? tortuosus *Cobbold*, pl. xl, fig. 4, p. 321 (3 specimens).
,, ? cingulatus *Cobbold*, pl. xl, fig. 5.
Polyzoa spp., pl. xl, figs. 7, 8; pl. xliv, fig. 26, p. 325 (4 specimens).
Lingulella *cf.* concinna *Matthew*, pl. xl, fig. 9, p. 327.
Obolus sp., pl. xl, fig. 10, p. 327.
Kutorgina ? anglica *Cobbold*, pl. xl, figs. 11-15, p. 328.
Acrotreta gemmula *Matthew*, pl. xl, figs. 16, 17, p. 330.
,, sagittalis (*Salter*), *var.* taconica *Walcott*, pl. xl, fig. 18.
Acrothele prima (*Matthew*), pl. xl, fig. 19, p. 330.
,, intermedia *Linnarsson*, pl. xl, fig. 20, p. 329.
Hyolithus oelandicus *Holm*, pl. xl, figs. 21, 22, p. 333 (2 specimens).
,, pennatuloides *Cobbold*, pl. xl, figs. 24, 25, p. 336 (2 specimens).
,, tenuistriatus *Linnarsson*, pl. xl, fig. 26, p. 333.
,, araneus *Holm*, *var.* angustus *Cobbold*, pl. xl, fig. 27, p. 336 (2 specimens).
,, obscurus *Holm*, *var.* anglicus *Cobbold*, pl. xl, fig. 29, p. 334.
,, operosus *Cobbold*, pl. xli, figs. 1-5, p. 335 (5 specimens).
,, sp., pl. xl, fig. 28, p. 334 (2 specimens).
,, (Orthotheca) cor *Holm*, pl. xl, fig. 23, p. 337.
,, (Orthotheca ?) ornatus *Cobbold*, pl. xl, fig. 6, p. 338.
Bradoria *cf.* obesa (*Matthew*), pl. xli, fig. 6, p. 379.
,, benepuncta (*Matthew*), pl. xli, fig. 7, p. 379.
,, robusta (*Matthew*), pl. xli, fig. 8, p. 378.
Beyrichona tinea *Matthew*, pl. xli, fig. 9, p. 380.
,, *cf.* rotundata *Matthew*, pl. xli, fig. 10, p. 380.
Aluta ulrichi *Cobbold*, pl. xli, figs. 11-13, p. 381 (3 specimens).
,, *cf.* rotundata (*Walcott*), *var.* salopiensis *Cobbold*, pl. xli, fig. 14, p. 381.
Indianites exigua *Cobbold*, pl. xli, figs. 15, 16, p. 382 (2 specimens).
,, obtusa *Cobbold*, pl. xli, fig. 17, p. 383.
Dielymella ? corpulenta *Cobbold*, pl. xli, figs. 18a-c, p 384 (2 specimens).
Corynexochus illingi *Cobbold*, pl. xli, figs. 19, 20, p. 371 (2 specimens).
,, pusillus *Illing*, pl. xli, fig. 21, p. 370.
Conocoryphe emarginata *Linnarsson*, *var.* longifrons *Cobbold* pl. xli, fig. 22, p. 345.
Dorypyge rushtonensis *Cobbold*, pl. xli, fig. 23, p. 373 (4 specimens).
Paradoxides bohemicus *Boeck*, *var.* salopiensis *Cobbold*, pl. xlii, figs. 1-3, p. 346 (3 specimens).
Paradoxides *cf.* oelandicus *Sjögren*, pl. xlii, figs. 4-6, p. 348 (3 specimens).
,, forchhammeri *Angelin*, pl. xlii, figs. 7, 8, p. 347 (2 specimens).
,, tessini *Brongniart*, pl. xlii, fig. 11, p. 349.
,, sp. indet. A, pl. xlii, fig. 9, p. 349.
,, sp. indet. B, pl. xlii, fig. 10, p. 350.
Solenopleura rushtonensis *Cobbold*, pl. xlii, figs. 12-16, p. 366 (5 specimens).
,, acadica [*Whiteaves* MS.] *Matthew*, *var.* elongata *Matthew*, pl. xlii, fig. 17, p. 362.
,, bucculenta *Grönwall*, pl. xlii, figs. 18a, b, p. 366 (2 specimens).
,, applanata (*Salter*), pl. xliii, fig. 1, p. 365.
,, brachymetopa *Angelin*, *var.* nuntia *Grönwall*, pl. xliii, fig. 2, p. 365.
,, ? angustiora *Cobbold*, pl. xliii, fig. 4, p. 363 (2 specimens).
,, ? sp., pl. xliii, figs. 3, 16, pp. 358, 369 (2 specimens).

Agraulos humilis *Cobbold*, pl. xliii, fig. 5, p. 377 (2 specimens).
,, robustus *Cobbold*, pl. xliii, figs. 6-9, p. 376 (3 specimens).
Liostracus bruno *Cobbold*, pl. xliii, figs. 10-13, p. 356 (5 specimens)
,, dubius (*Cobbold*), pl. xliii, fig. 14, p. 358 (2 specimens).
,, (Agaso) pringlei *Cobbold*, pl. xlv, figs. 1a-d, p. 361.
,, (,,) pococki *Cobbold*, pl. xlv, figs. 2a-d, p. 360.
,, (,,) rushtonensis *Cobbold*, pl. xlv, figs. 3a-d, p. 359.
,, (,, ?), *Pygidia*, pl. xlv, figs. 4-6, p. 361 (3 specimens).
,, ? sp., pl. xliii, figs. 15, 17, p. 358 (2 specimens).
Agnostus rotundus *Grönwall*, pl. xliv, figs. 1, 2, p. 343 (2 specimens).
,, gibbus *Linnarsson*, pl. xliv, figs. 3, 4, p. 341 (2 specimens).
,, lens *Grönwall*, pl. xliv, figs. 5-8, p. 342 (6 specimens).
,, fissus [*Lundgren* MS] *Linnarsson, var.* mancus *Cobbold*, pl. xliv, figs. 9-12, p. 340 (4 specimens).
,, parvifrons *Linnarsson*, pl. xliv, figs. 13-19, p. 343 (7 specimens).
,, lundgreni *Tullberg*, pl. xliv, figs. 20, 21, p. 342 (2 specimens).
,, stenorrhachis *Grönwall*, pl. xliv, fig. 22, p. 342 (2 specimens).
Eodiscus speciosus (*Ford*), pl. xliv, figs. 23, 24, p. 344 (2 specimens).
Ellipsocephalus nordenskjöldi *Linnarsson*, pl. xliv, fig. 25, p. 374.
Eurycare angustatum *Angelin*, pl. xlv, figs. 7, 8, p. 351 (2 specimens).
Ctenopyge drytonensis *Cobbold*, pl. xlv, figs. 9a-d, 15a, 19, p. 352 (8 specimens).
,, flagellifera (*Angelin*), pl. xlv, figs. 15b, 16, 17, p. 351 (3 specimens).
,, flagellifera, *var.* angusta *Westergård*, pl. xlv, figs. 14, 15c, d, p. 351 (2 specimens).
Sphaerophthalmus ? parabola *Cobbold*, pl. xlv, figs. 11-13, p. 353 (3 specimens).
,, ? sp., pl. xlv, fig. 10, p. 355.
Leptoplastus raphidophorus *Angelin*, pl. xlv, fig. 18, p. 351.

In the Transactions of the Leeds Geological Association, Volume I, Part ii.

Anthracoceras *from the E_2 Zone of the Namurian.*

By Mr. W. S. Bisat, F.G.S.

Anthracoceras cherryi *Bisat*, text-figs. 1-3, p. 116 (2 specimens).
,, glabrum *Bisat*, text-figs. 8, 10 (2 specimens).
,, discoides *Bisat*, text-figs. 4-7 (2 specimens).
,, *cf.* discoides *Bisat*, text-fig. 11.
,, paucilobum (*Phillips*), text-figs. 9, 12 (2 specimens).

B. Scotland

No points of outstanding interest have arisen in connexion with the work of this department in Edinburgh during the year. The selection of fossils for five regional exhibits, which are being assembled, is now nearly complete, and the work has been carried out by Dr. Pringle with assistance from Messrs. Eckford and McCall.

J. Pringle.

2. PALAEOBOTANICAL WORK

IDENTIFICATIONS of fossil plants have been made from One-inch Sheets (England) Nos. 9 (Rothbury), 20 (Newcastle-on-Tyne), 28 (Whitehaven), 70 (Leeds), 78 (Wakefield), 84 (Wigan), 85 (Manchester), 110 (Macclesfield), 155 (Bagworth), 233 (Monmouth), 289 (Canterbury) and (Scotland) 44 (Mull), the chief items being for the Lancashire and Yorkshire units. The numerous miscellaneous identifications made include those for the various Regional Exhibits in the Museum; the Geological Department of Leeds University (the Bond Collection); Dr. L. G. G. Warne, Manchester University; the Manx Museum, Isle of Man; Mr. W. Hemingway of Derby; Dr. R. G. S. Hudson of Leeds; Mr. J. Walton of Brighouse, and the Manager of the New Sharlton Colliery Co., Yorkshire.

In the curating of the plant collections valuable assistance has been given by Mr. E. G. Radley. Advantage has been taken of the transference of the Kidston Collection to new cabinets to rearrange the specimens, reference to particular genera and species now being greatly facilitated. A detailed catalogue of this collection has been prepared and may be published in a reduced and modified form. The large collection of fossil plants formerly exhibited in the galleries of the Jermyn Street Museum have been arranged and card-indexed. The Survey collection of plant incrustations has been transferred to suitable quarters.

Museum work has claimed a considerable amount of time. To the Coal Exhibit floor-cases have been added illustrating the various data by which coal seams are identified and correlated, while generalised vertical sections of our chief coalfields are in course of preparation. Additions have been made to a number of the other cases, including a series of drawings by the Palaeobotanist illustrating various features of the fossil plants exhibited. Specimens for inclusion in the Coal Exhibit have been received from the Fuel Research Department, from Professor R. V. Wheeler of Sheffield and from Messrs. Stephenson Clark & Co., London. In preparing the Bristol and Gloucestershire Regional Exhibit and the published account of the district, collaboration has been secured with Dr. F. B. A. Welch.

The Palaeobotanist has provided specimens of fossil plants, micro-slides, photographs, labels, etc., for the other Museum exhibits which contain important plant-bearing beds, and has given assistance with those sections of the Regional descriptions that deal with fossil plants.

Work in connexion with loans of specimens, micro-slides, photographs, etc., to outside workers has been particularly heavy during the year, while the number of miscellaneous enquiries continues to increase. Numerous visits have been made to the collections by research workers. Working largely on specimens lent by the Museum of Practical Geology a Monograph of the first importance has been published by Professor T. G. Halle of

Stockholm, while Dr. M. Benson (Hertford), Dr. R. Florin (Stockholm) and Dr. E. Dix (London) have descriptive accounts in hand. The Palaeobotanist has been able to assign certain doubtful beds in a borehole at Bollington, near Macclesfield, to the Coal Measures and has shown that the Yard and Bulldog Mines of the Lancashire Coalfield are not identical.

Miscellaneous work has included the checking of proofs for the press, the registration of fossil plants and of micro-slides, the sectioning and reporting on fossil woods and ' coal balls ' and the answering of numerous enquiries relative to coal resources, structures in coals, etc. There has also been correspondence with several American geologists regarding the correlation of the Coal Measures of the United States with those of Britain.

The following plant specimens have been described, figured or mentioned in publications :—

IN KUNGL. SVENSKA VETENSKAPSAKADEMIENS HANDLINGAR,

Tredje Serien, Bd. 12, No. 6, 1933, pp. 1-103, pl. 1-15.

The Structure of Certain Fossil Spore-bearing Organs believed to belong to Pteridosperms

By PROFESSOR T. G. HALLE

Boulaya (Whittleseya) fertilis (*Kidston*) *Carpentier,* p. 25; Kidston Coll. No. 4695.

Aulacotheca elongata (*Kidston*) (Rhabdocarpus elongatus *Kidston pars*), pl. vii, figs. 1-14, p. 30; Kidston Coll. No. 169; p. 36; Kidston Coll. No. 6799.

Aulacotheca hemingwayi *Halle* (Rhabdocarpus elongatus *Kidston pars*), pl. viii, fig. 1, p. 37; Kidston Coll. No. 1657; pl. viii, figs. 14-16, p. 37; Kidston Coll. No. 5852; pl. viii, fig. 4, p. 37; Kidston Coll. No. 3750; pl. viii, fig. 5, p. 37; Kidston Coll. No. 3751.

? Aulacotheca hemingwayi *Halle*, pl. viii, fig. 2, p. 39; Kidston Coll. No. 1445.

Potoniea (Neuropteris) carpentieri (*Kidston, Halle*), pl. xiii, fig. 3, p. 76; Kidston Coll. No. 5497; pl. xiii, fig. 4, p. 76; Kidston Coll. No. 5498.

Schuetzia bennieana *Kidston,* pl. xv, figs. 5-7, p. 103; Kidston Coll. No. 161.

IN PALAEONTOGRAPHICA BEITRÄGE ZUR NATURGESCHICHTE DER VORZEIT, Bd. lxxviii, Abt. B, 1933.

The Succession of Fossil Plants in the Millstone Grit and the Lower Portion of the Coal Measures of the South Wales Coalfield (near Swansea) and a Comparison with that of other Areas.

By DR. EMILY DIX, F.G.S.

Sphenophyllum *sp. nov.*? (Cf. S. cuneifolium *Sternb.*), text-fig. 13, p. 194; Survey Coll. No. R. C. 1377.

Lyginopteris stangeri (*Stur*), pl. xx, fig. 5, p. 200; Survey Coll. No. R. C. 1355.

Sphenopteris hollandica *Gothan and Jongmans,* pl. xx, fig. 10, p. 200; Survey Coll. No. R. C. 903.

Rhodea *cf.* stachei *Stur,* pl. xx, fig. 11, p. 200; Survey Coll. No. R. C. 1326.
Alcicornopteris *cf.* zeilleri *Vaffier,* pl. xx, fig. 18, p. 200; Survey Coll. No. 1331.
Adiantites sp., pl. xx, fig. 19, p. 200; Survey Coll. No. R. C. 1436.
Neuropteris *cf.* schlehani *Stur,* pl. xx, fig. 24, p. 200; Survey Coll. No. R. C. 1344.
Bothrodendron punctatum *L. & H.* and Lepidophloios acerosus (*L. & H.*), pl. xx, fig. 44, p. 201; Survey Coll. No. R. C. 822.
Sigillaria elegans *Brongt.,* pl. xxi, fig. 53, p. 200; Survey Coll. No. R. C. 1306.
Sphenopteris obtusiloba *Brongt.,* pl. xx, fig. 46, p. 201; Survey Coll. No. R. C. 547; pl. xxi, fig. 41, Survey Coll. No. 53080.
Lepidostrobus *sp. nov.* ?, pl. xx, fig. 52, p. 201; Survey Coll. No. R. C. 1297.
Neuropteris schlehani *Stur,* pl. xxi, fig. 54, p. 201; Kidston Coll. No. 4136.
Neuropteris schlehani *forma* rectinervis *Kidston,* pl. xxi, fig. 58, p. 201; Kidston Coll. No. 6007; pl. xxi, figs. 60, 66A, p. 202; Survey Coll. No. R. C. 816; pl. xxi, fig. 61, p. 202; Kidston Coll. No. 844; pl. xxi, fig. 62, p. 202; Kidston Coll. No. 846; pl. xxi, fig. 63, p. 202; Kidston Coll. No. 845; pl. xxi, fig. 64, p. 202; Survey Coll. No. R. C. 802.

IN ANNALS OF BOTANY, VOL. XLVIII, 1934

Note on the ' Spores ' of Schuetzia bennieana *(Kidston)*

By DR. MARGARET BENSON, F.L.S.

Schuetzia bennieana (*Kidston*), text-figs. 1-3, pp. 819-820; Kidston Coll. No. 2010.
Schuetzia *cf. bennieana* (*Kidston*), pp. 819-820; Kidston Coll. No. 161.

IN TRANSACTIONS OF THE ROYAL SOCIETY OF EDINBURGH, VOL. LVIII, 1933-34.

Notes on the Kidston Collection of Fossil Plant Slides, V, VI.

By DR. MARY G. CALDER

Lepidodendron brevifolium *Will.,* pl. i, fig. 5, p. 124; Kidston negative No. 263; pl. i, fig. 8, p. 124; Kidston negative No. 262; pl. ii, fig. 12, p. 124, Kidston negative No. 254; pl. ii, fig. 13, p. 124; Kidston negative No. 253.

R. CROOKALL.

3. PETROGRAPHICAL WORK

THE normal petrographical work in connexion with areas being surveyed has of necessity given place to the requirements of the new Museum. The petrographer, therefore, apart from dealing with the usual large number of scientific enquiries, has been occupied in the preparation of petrological exhibits in the Museum, and in assisting geologists in the selection of petrographical material to form part of exhibits of a regional character. Amongst the enquiries were many of archaeological interest chiefly the determination of the source of material used in the making of neolithic axes, and prehistoric pottery.

The detection of Niedermendig tephrite at Meon Hill adds yet another interesting occurrence of this material in prehistoric sites in southern England. The fragment was part of a quern.

Another rock of wide prehistoric distribution is the Craigllwyd granophyre of Carnarvonshire. It has now been found as axes at a great many Neolithic sites all over England, and further instances have recently been brought to light from Hampshire and from the Kennet Avenue at Avebury lately excavated by Mr. Alexander Keiller. Prehistoric pottery from Cheltenham has proved to have a granitic base, as was found to be the case of certain Iron-age Pottery from the site of Meon Hill, excavated by Miss D. Liddell.

Assistance has been given to Mr. Horace Beck in the determination of both natural and artificial material used as beads collected from the ancient sites of Ur and elsewhere. Reports have been given to the Home Office on matters relating to the haematite-deposits of Cumberland and South Wales, and on other matters related to the study of the contributory causes of silicosis, such as the nature of the dust yielded by certain slates and other rocks in the process of working. The petrological examination of dust particles precipitated from the atmosphere by means of a thermal precipitator and other devices, has been carried out with a view to ascertaining the minimum size of particles that can be identified petrologically with anything like certainty.

Assistance has been given to the Committee of the British Institute of Industrial Art in the preparation of their report on stones used for graveyard memorials.

In the Museum the Petrographer with the assistance of Miss E. M. Guppy and Mr. T. G. Jones has continued the preparation of an extensive exhibit of the rock-forming minerals. He has also, with Mr. E. E. L. Dixon and Professor T. N. George commenced work on the regional exhibit to illustrate the geology of South Wales, and during the autumn he visited many localities in the Lower Palaeozoic region of South Wales, in ground surveyed by himself and others.

Scotland

In Scotland, as in England, routine petrographical work has been replaced almost entirely by the work necessitated by the pre-

paration of exhibits for the Museum to illustrate the geology of selected Scottish regions. Dr. Phemister has been engaged on work connected with the North-West Highlands, Professor H. H. Read with the North-East of Scotland, Dr. Richey with the Western Isles and Argyllshire, Mr. A. G. MacGregor with the Central Valley, and Dr. J. Pringle with the Southern Uplands. In all cases good progress has been made and the exhibits are nearing completion.

HERBERT H. THOMAS.

4. CHEMICAL WORK

QUANTITATIVE chemical work during the early part of the year was disorganized by the assembly of the new laboratory. The bulk of the analyses, of which a selection is given below, were carried out for the Shetland and Sheet 52 (Argyll and Inverness) Memoirs.

965. *Magnetite.* Band, from 8 ft. to 10 ft. thick, in schists. South shoulder of Clothister Hill, ¾ mile W. of Sullom. Six-inch map, Shetland, 24 S.E. Slice No. S 30030.

966. *Chloritoid-gneiss* (*altered andalusite-kyanite-gneiss*). Hillside, 60 yds. S.E. of Coubal, Sconsburgh. Six-inch map, Shetland, 65 N.W. Slice No. S 30031.

967. *Garnet-staurolite-schist,* in a metamorphic sequence. 450 yds. S.S.E. of S. end of Lamba Water, and 1,230 yds. W.N.W. of West Setter, Weisdale. Six-inch map, Shetland, 43 S.W. Slice No. S 30032.

968. *Hornblende-felspar-rock,* intrusion in a kyanite-bearing gneiss. Road at North Voe, 550 yds. due E. of Salt Ness, Symbister, Whalsey. Six-inch map, Shetland, 24 S.E. Slice No. S 30029.

970. *Gabbroic variation of a dioritic intrusion.* Hillside, 150 yds. N.E. of the Lock of Arg. Six-inch map, Shetland, 51 N.W. Slice No. S 30035.

969. *Slightly foliated granite,* variation of the Hildasay granite. Shore, St. Mary's Chapel, Sand. Six-inch map, Shetland, 47 S.E. Slice No. S 30034.

964. *Graphitic siliceous schist.* Burn of Vestavirdin, ¾ mile W. of Sullom. Six-inch map, Shetland, 24 S.E. Slice No. S30029.

971. *Bauxitic clay.* 3-ft. bed of bauxitic clay, a few feet above base of Millstone Grit, resting upon Ordovician greywackes. Six-inch map, Dumfries, 6 S.W.

972. *Quartz-porphyry,* intrusion or lava. Mabebapudi Hills (Koppies), about 17 miles S. of Ngami, Bechuanaland Protectorate, South Africa. Slice No. F. 3696.

973. *Garnet-sillimanite-staurolite-mica-schist* (*pelitic schist*). Band in Moine Schists. 1,700 yds. N. 15° W. of Dalelia, Loch Shiel, Moidart. Six-inch map, Inverness, 157 N.E. Slice No. S 30272.

974. *Garnetiferous mica-schist* (*pelitic schist*). Band in Moine Schists. 170 yds. W. 10° S. of S. end of Loch Blain, near Acharacle, Moidart. Six-inch map, Inverness, 157 N.W. Slice No. S 30275.

975. *Augen-gneiss.* Injection rock of Moine Series (pegmatite-injected mica-schist). Strontian River, 200 yds. down stream from junction with Allt Feith Dhomhguill (burn with old lead mine alongside). Six-inch map, Argyll, 18 S.E. Slice No. S 30276.

[TABLE]

Lab. Nos.	965	966	967	968	970	969
SiO_2 ...	7.23	53.45	54.13	49.06	51.98	62.74
Al_2O_3 ...	0.17	25.34	27.02	24.07	18.70	16.69
Fe_2O_3 ...	60.14	6.32	5.12	0.85	1.62	1.60
FeO ...	28.20	2.42	2.95	5.07	3.95	3.39
MgO ...	1.40	1.49	1.95	5.43	5.94	2.54
CaO ...	2.26	1.00	0.86	8.58	8.88	5.19
Na_2O ...	0.10	2.09	1.64	3.07	3.20	3.22
K_2O ...	0.20	3.43	2.86	0.94	2.27	2.75
$H_2O > 105°$	0.29	3.04	1.69	1.78	0.86	0.44
$H_2O < 105°$	0.06	0.14	0.16	0.18	0.18	0.13
TiO_2 ...	0.42	1.33	1.23	0.63	1.36	0.64
P_2O_5 ...	0.03	0.10	0.30	0.24	0.66	0.23
MnO ...	0.00?	0.05	0.21	0.06	0.07	0.12
CO_2 ...	0.00?	0.00?	—	0.16	—	0.00?
FeS_2 ...	—	—	0.12	0.25	0.24	0.03
Fe_7S_8 ...	—	—	—	0.00?	—	—
Cr_2O_3 ...	—	0.02	0.03	0.00?	0.03	0.02
BaO ...	—	—	—	—	—	0.04
Li_2O ...	—	—	0.00?	0.00?	—	—
Rare earths	—	—	—	—	—	0.04
Totals ...	100.50	100.22	100.27	100.37	99.94	99.81
Analysed by	B. E. Dixon.					C. O. Harvey.

Lab. Nos.	964	971	972	973	974	975
SiO_2 ...	53.0	50.65	72.10	58.77	58.29	72.57
Al_2O_3 ...	19.5	31.02	12.04	19.69	19.53	13.04
Fe_2O_3 ...	0.2*	0.68	4.63	0.88	1.02	0.31
FeO ...	7.9*	1.94	0.29	6.88	6.85	2.84
MgO ...	5.0	0.50	0.29	2.43	2.24	0.67
CaO ...	1.1	0.37	1.11	1.61	2.30	1.36
Na_2O ...	2.0	} 0.31	3.20	1.95	2.25	3.07
K_2O ...	2.3		5.31	3.68	3.59	4.97
$H_2O > 105°$	4.2	11.36	0.00?	2.20	2.00	0.26
$H_2O < 105°$	0.2	0.60	0.12	0.12	0.08	0.05
TiO_2 ...	1.5	2.02	0.35	1.17	1.13	0.62
P_2O_5 ...	0.0?	—	0.10	0.31	0.31	0.13
MnO ...	0.1	—	0.04	0.07	0.13	0.04
CO_2 ...	0.7	0.95	0.34	—	—	0.00?
FeS_2 ...	1.0	—	0.07	0.00?	0.00?	0.08
Fe_7S_8 ...	1.5	—	—	—	—	0.00?
Cr_2O_3 ...	—	—	0.00?	0.01	0.01	0.01
BaO ...	—	—	—	0.08	0.09	0.05
C	0.3	—	—	—	—	—
Totals ...	100.5	100.40	99.99	99.85	99.82	100.07
Analysed by	B. E. Dixon.			C. O. Harvey.		

* See note in text.

LAB. No. 982.

Volatile and combustible matter.			
Moisture ...	4.1		
C	23.4		
N	3.0		
CO_2	trace		
Remainder ...	21.2		
		51.7	
			Percentage composition of Ash.
Ash.			
SiO_2	22.2		46.2
Al_2O_3	3.7		7.8
Fe_2O_3 } ...	7.1		11.4
FeO }			3.3
MgO	1.2		2.4
CaO	7.9		16.5
Na_2O	1.0		2.1
K_2O	1.0		2.0
TiO_2	0.5		1.0
SO_3	3.7		7.6
P_2O_5	trace		trace
CO_2	trace		trace
Heavy metals	trace		trace
		48.3	
TOTAL ...		100.0	100.3

Analysed by B. E. DIXON.

Lab. No. 982 gives the analysis of a London dust, undisturbed for eighty years. Owing to the presence of sub-graphitic matter in Lab. No. 964, the figures for oxides of iron are only approximate. The rapid and accurate determination of carbon in rocks may present difficulties, especially when the sample contains a considerable amount of carbonate or volatile carbon compounds, or when the form of carbon is unknown. A wet combustion process for the estimation of carbonate and non-carbonate carbon has been devised.[1]

B. E. DIXON.

[1] 'The Determination of Carbon in Rocks and Minerals,' B. E. Dixon, *Analyst*, vol. lix 1934, p. 739.

IV. MUSEUM OF PRACTICAL GEOLOGY

THE main work throughout the year was the removal of the collections, library, and offices to the new building at South Kensington. Begun in January, the transference was completed by 31st October, when the Museum in Jermyn Street was formally surrendered to the Commissioners of Crown Lands.

Considerable progress has now been made with the arrangement of the exhibited collections in the new Museum. On the Ground Floor the exhibits illustrating the Weald and the London and Thames Valley Districts are now practically completed; the cases containing the display of precious and semi-precious stones have been set out and labelled; and the sectional displays illustrating the general principles of geology are now well advanced. Seven dioramas of subjects of scenic and geological interest have been placed in position, and the preliminary work for the completion of four more has been completed.

Work on the regional exhibits on the First Floor gallery has made steady progress; several of the displays are now complete and the selection and labelling of the material for the remainder is being undertaken as rapidly as circumstances permit.

The Economic Collections on the Second Floor Gallery have been set out and labelled, and a beginning has been made with the arrangement of the larger and more striking specimens in the island cases which form a central feature in each bay. A certain amount of furniture, more particularly special wall-cases and diorama-cases, has yet to be delivered by H.M. Office of Works for this floor, but it is hoped to have the exhibits completed in time for the opening of the Museum.

The registration of current acquisitions has been kept up-to-date and 1,161 entries have been made in the permanent inventory.

The Reserve and Study Collections are now in preliminary order. They comprise about 2,000 drawers filled with picked minerals and, although of necessity the work of re-marking the inventory and catalogue cards is postponed meanwhile, the arrangement is such that specimens are readily accessible.

The Library is now installed and has been open to the public since 5th November. The Main Library is practically completely equipped, and only a small amount of furniture is outstanding for the Small Library which has been mainly furnished with the book-cases from the Jermyn Street building. The removal was made the occasion for a complete reorganization of the books which are now being press-marked. Although a considerable time must elapse before this task is completed, the existing arrangement is such that books are in most cases easily obtainable by the staff.

The additions made during the year comprise 95 volumes of independent works, 178 reprints, 2,727 volumes and parts of serials, and 182 maps. There were supplied to public order 265 photographs, 96 lantern slides, and 10 photoprints of Survey maps.

W. F. P. McLintock.

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